BBC·MASTER·ELECTRON·ARCHIMEDES

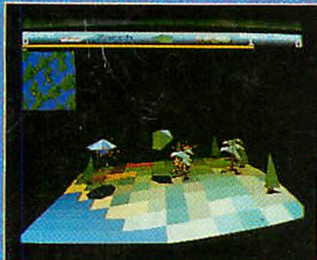
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ACORN USER

DECEMBER 1987

BIGGEST AND BEST-SELLING ACORN MAGAZINE

ZARCH:



Top marks!

PCB CAD: Computer-aided circuit design

FORUM: Broken directory fixer for ADFS

THREE Cs: Acorn, Beebug, Mijas review

MONITORS: Nine models compared

ART
Special issue

The Life Of Repton

REPTON HAS WANDERED FROM HIS COT. THE JOURNEY BACK IS PERILOUS

THERE ARE MANY ENEMIES ON THE WAY, ALL OUT TO STOP HIM

A NEAR MISS FOR REPTON!

CRASH!

CAN HE MAKE IT TO THE TRAIN AND PAST THE SOLDIERS?

HE'S PASSED THE SOLDIERS, BUT WHERE ARE THE BRAKES?

THUMP

NO MATTER, REPTON LIVES TO FIGHT ANOTHER DAY.

REPTON AS A BABY

OH NO - I'M LATE FOR THE FIRST DAY OF SCHOOL!

REPTON TEARS OUT OF HIS HOUSE

GET LOST YOU HORRIBLE MUT!

BUT THERE ARE ALWAYS OBSTACLES ON THE WAY–

COME 'ERE REPTON YOU LITTLE CISSY!

LIKE ADOLF THE ALSATION – THE BASH ST GANG

AND THE HEAD - OLD BEAKEY

TERM STARTS TOMORROW

BETTER LUCK TOMORROW REPTON!

REPTON AT SCHOOL

TEENAGE REPTON IS A TEARAWAY-TODAY HE'S ON A MISSION.

OOH THAT REPTON USED TO BE SUCH A NICE BOY!

RONS RECORDS

HE'S AFTER BLOND BECKY AT RONS RECORDS

OH OH - REPTON'S ARCH RIVALS, THE MODS - ROAR UP THE ROAD

'ERE WE'VE BEEN LOOKING FOR YOU - BOG BRUSH HEAD

COME ON REPTON - OVER 'ERE SON!

A PILE OF BRICKS WAS HIS ONLY CHANCE

BET YOU DAREN'T CHUCK IT

REPTON, DARED!

YOU ASKED FOR IT YOU CREEPS!

BUT THE BRICK KEPT FLYING - AND WHO GOT IT - YEP YOU GUESSED, RONS RECORDS - ROMANCE WAS OUT OF THE WINDOW!

REPTON AS A TEENAGER

REPTON IS GROWING UP FAST - HE'S NOW A FULLY FLEDGED YUPPIE

WELL DONE REPTON - THERE COULD BE AN EARLY PROMOTION FOR YOU

BUT A BIT OF A CREEP WITH IT! ALWAYS WORKING LATE AND ALWAYS CRAWLING TO THE BOSS

REPTON BECOMES UNBEARABLE

AS YOUR FUTURE BOSS - I PROMISE TO BE FIRM BUT FAIR I PROMISE TO

BUT IN FULL FLIGHT - HE KNOCKS A COFFEE MUG OVER–

BLAH-BLAH

SPLASH

BOOM

AND DISASTER FOLLOWS!

WELL REPTON DIDN'T GET HIS EARLY PROMOTION–

– BUT DO YOU LIKE HIS NEW UNIFORM!

REPTON AT WORK

REPTON IS GETTING ON IN YEARS NOW - BUT HE STILL ENJOYS A PINT AT THE LOCAL

AND I GOT THIS ONE WHEN ME AND FRED WERE TRAPPED IN A FOXHOLE AND...

AT THE PUB HE ALWAYS BOASTED OF HIS WAR EXPLOITS AND HIS COLLECTION OF MEDALS

UNTIL ONE DAY...

OY' REPTON THIS MEDAL HERE HAS GOT THE BATTLE OF WATERLOO ON IT, AND THIS ONE...

HELP!

WHAT ABOUT ALL THEM FREE DRINKS FOR OUR LOCAL WAR HERO THEN?

AND I DONATED TO THE REPTON WAR COLLECTION FUND!

GIMME MY MONEY BACK YOU OLD FRAUD!

COME HERE REPTON!

REPTON ONLY KNEW ONE MILITARY ORDER – RETREAT!

TO FACE THE ONLY ENEMY HE HAD EVER REALLY FOUGHT!

IT'S A REPTON'S LIFE!

REPTON AS AN OLD MAN

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THE CHARACTER EDITOR

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ISSUE No 65 DECEMBER 1987

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FEATURES

COVER



Illustration by David Wood

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But *how* do you draw it?
– practical micro art
Remote control micros
Plus: the best games of '87
and the latest on the Arc

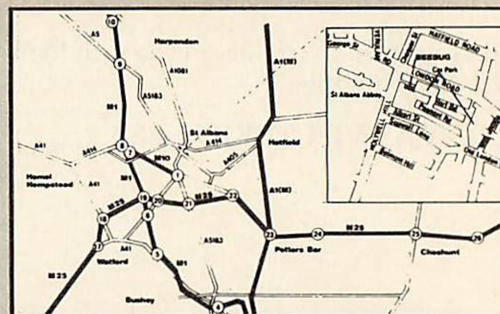
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1014B View Driver Disc	9.77	9.29
1002B Hi-View	44.28	42.06
1021A ViewIndex Disc	13.80	13.11
1043B ViewSpell ROM	34.02	32.32
1001B ViewSheet	32.63	31.00
1030B ViewPlot	25.30	24.04
1019B ViewStore ROM	44.28	42.06
1023C View Professional	99.95	94.95
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0603F Cumana CS400 40/80	162.15	154.04
0615F Cumana CS400E	155.00	147.25
0604G Cumana CD800S 40/80	286.35	272.03
0611A Cumana Disc Guide	1.90	1.81
0650B 10 x Memorex Discs SS 40	15.50	14.73
0651B 10 x Memorex Discs DS 80	25.50	24.22
0669B 10 x Memorex 3.5" Discs	25.00	23.75
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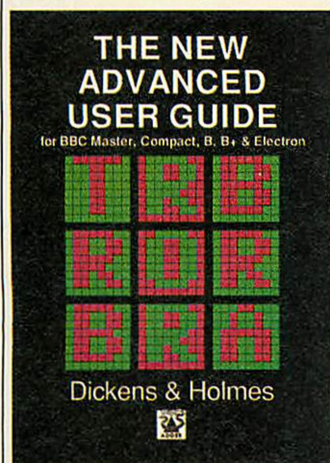
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0214B Watford DDFS Kit	56.35	53.53
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0709D Watford Eprom Eraser	33.35	31.68

NEWS

Micro guide revised

The programmer's bible has been brought up to date. The *New Advanced User Guide* contains all the detailed information programmers need. The new version, published by

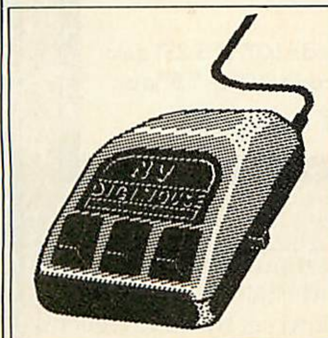


Essential reading updated

Adder at £19.95, now includes Master and Compact topics such as CMOS RAM and the real-time clock.

Cheaper art

Nidd Valley is a late entry into the art package market but its new *Illustrator* software is inexpensive – for just under £50 you get the software and Nidd Valley's Digimouse. However,



***Illustrator*: low price graphics**

the software works with any BBC-compatible mouse, and costs £20 by itself.

Illustrator is disc based and includes pixel and font editors and other utilities.

MS-DOS Arc enters education battle

By Steve Mansfield

Acorn is looking to corner all sections of the education market by launching an MS-DOS version of the Archimedes and an interface which lets IBM-compatible PCs link in to Econet. The prices of the 300 series have also been dropped by £100.

The 310M is essentially a standard Archimedes 310, but comes with the software-based PC emulator and the latest version of MS-DOS, version 3.21. The machine will also work as a normal Archimedes.

This launch comes at a time when the education world is hotly debating the relative merits of MS-DOS, which is the standard micro operating system in business, and proprietary operating systems, particularly Acorn's.

Acorn has refused to be drawn into the argument. Michael Page, the company's communications manager, told *Acorn User*: 'There is some need for MS-DOS in parts of education. We provide a flexible architecture which can be adapted to various needs.'

On the price drop, Page



Page: price dropped

claimed that the original figures were only ever tentative and that most of the units sold to date have gone to third party software developers for evalutation purposes.

Now that sales have started in earnest, Acorn has been able to fix the recommended retail price. By the same token, prices quoted for the 400 series are also subject to change.

The new prices for the 305 and 310 are £804 and and £890 for the base systems, rising to £1034 and £1121 for colour systems. The 310M costs £960 for a base system, £1018 with a monchrome monitor and £1190 for a colour system.

■ Arcs and the BBC micros can now be mixed with PCs on the same network. Acorn's new PC-EcoLink card is an internal board which interprets the PC's filing commands into a form which can be understood by Econet. Among other things, this means that PCs and Arcs can share data files for packages available on both machines, such as Grafox' *Logistix*. The card costs £344 (inc VAT).

As reported last month, the cost of developing the Archimedes series resulted in losses for Acorn over the first half of this year. However, the company's brokers, Philips and Drew, are predicting that 1988 will be a good year for Acorn. Next year will see the launch of the RISC-based workstations, and to fund this development Acorn may well make a share issue. This could effectively reduce Olivetti's holding in the company from 79 per cent to just over 50 per cent.

Sound of music on Micronet

Micronet is about to open a music section for Hybrid Music System owners. For a fee, subscribers will be able to download software for the Hybrid synthesiser and music editing systems.

Ian Burley, news editor of Micronet, said: 'We will be supporting the section for the Music 500 and 5000. It is being prepared right now and will be on-line soon.'

Hybrid users who do not have access to telesoftware can turn to *Amplines*, a bi-monthly disc-based magazine. Editor Kevin Doyle aims to provide a forum for news, information, music and programs written in Ample, the music language. A Music 500/5000 system is necessary to run the discs. Subscriptions are £5 plus a blank formatted 40/80-track disc from Amplines, 26 Arbor Lane, Winnersh, Berks.

Epnitex ready to go on line

The Epnitex viewdata system, first mentioned in *Acorn User* back in April, is finally ready to launch.

Although hailed as a rival to Prestel, the main market for Epnitex is large companies who can use the system for in-house communications as well as a public display system.



Epnitex: radiopager link

To help attract the business user, Epnitex has teamed up with Mercury to offer a radiopaging service. For £150 a year, you're given Mercury's pen-style pager, which bleeps each time a new message arrives for you on the system. If you are online at the time a message also flashes on your screen.

Show launches

Several new products are to be launched at the Electron and BBC Micro User Show (Horticultural Hall, London November 13-15).

Watford Electronics will be showing a 30Mb hard disc, a front end system for the DFS and printer and disc sharers. The *Quest* range is being extended with a *Quest Paint* extension ROM and desktop publishing software.

Computer Concepts says it will finally have its wordprocessing and design packages for the Archimedes, although the company said that about the *Acorn User* show too.

Several games will be ready, including contract bridge in the form of *Black Queen* and a strategy game called *Bismarck*, both from BBC Soft.

Baker demands better use of school micros

By Bill Penfold

Education Secretary Kenneth Baker has ordered special attention be given to computers and information technology in the new 'national curriculum'.

The announcement follows an HMI report last summer criticising the 'inadequate' funding of high technology equipment and the 'disappointingly limited' use of micros.

The inspectors complained that the effective use of equipment across the curriculum is still rare.'

Mr Baker, in his drive to establish a national curriculum, has clearly taken note of the inspector's findings. At least two of the specialised working groups he has appointed to advise him have been instructed to carefully consider how new technology could and should influence the contents of the new curriculum.

As in the past, the HMI report claimed primary schools tended to make fuller use of equipment than secondary.


Baker: 'themes and skills'

It stated 'computers were in use in a small proportion of classes' and examples of 'effective work' were mainly in primary schools.

However, Mr Baker has told the specialist groups advising on science and mathematics attainment targets and study programmes he wants particular attention given to the future use of classroom computers.

Spelling out the science working group's terms of reference, the Education Secretary said there were a number of important subjects, themes and skills which could be taught and developed through the foundation subjects.

'I look to you to consider the place of such aspects within the science curriculum,' he told group's chairman, Professor J J Thompson of Bath University's School of Education.

Mr Baker added he expected the group's study to include 'the practical use and application of computers and informational technology in control, simulation and data storage'.

Similar instructions have been given to the head of the maths group, Professor R Blin-Stoyle. Mr Baker added: 'You will need to consider carefully how new technology can and should influence the mathematics curriculum.'

Both groups will deliver interim reports to the Education Secretary in November and their final reports next summer.

Micronet aids Children in Need

It looks as though the electronic medium has finally come of age. Micronet is to be given equal ranking with radio in the BBC's forthcoming charity telethon for Children in Need.

Last year Micronet was stuck in a dressing room. This year, however, the company will be running eight terminals in its own booth, alongside the BBC local radio stations, in the main studio itself.

The Children in Need appeal happens on November 27 and, as always, will be hosted by Terry Wogan. Micronet will be interviewing the various celebrities who pass through the studio, and there will be an online auction of computer goods.


Terry Wogan hosts appeal

A list of the auction goods will be put up on Micronet a week before the event so that you can get your bids in early.

On the night of the show, bids will be taken right up to midnight. The auction section will be open to all Prestel users, not just Micronet subscribers. You can take part even if you don't have a Prestel account. Local Information Technology Centres (ITeCs) will stay open that night, permanently logged on to Prestel.

Last year, Micronet's efforts raised just over £46,000. This year it hopes to increase that to £50,000 or more.

If you're a company with products or services you could donate, Micronet would like to hear from you. Contact Encarnita Round or Sid Smith on 01-278 3143.

Arc prize

The Archimedes has picked up its first award. The machine picked up the title of Home/ Small Business Computer of the Year in the British Microcomputing Awards.

The Acorn micro beat the Amstrad 1512 PC clone and the Amiga 500, mainly because of its advanced technology, based on the RISC chip, and its ability to run MS-DOS as well as Acorn's own operating system.

Win an Arc in our DTP competition

There's an Archimedes 305 plus £750-worth of software at stake in the Great Newspaper Competition run by *Acorn User* with AMS, producers of the *Stop Press* publishing package.

What you have to do is produce the front page and on inside page of an A3 tabloid newspaper (about the same size as *Today*) and a synopsis of the readership you are aiming at. It must be a national paper, but could be aimed at a large specialist group such as sportmen, children, or pensioners.

To make up a full A3 page, you will have to join several standard-sized pages together. The pages can be produced on any BBC-based hardware and software – except a laser printer. Editorial content will be as important as layout and design.

Entries must be in by February 29 1988, and there will be three age groups: under 14, 14-18 and over 18. Group entries by schools will be accepted.

The rules were announced last month on page 17. If you missed them, send an SAE to: The Great Newspaper Competition, *Acorn User*, 20-26 Brunswick Place, London N1 6DJ.

File transfer made easy

The biggest problem with buying one of the latest incarnations of the BBC micro is transferring software from your old machine. Datathorn Systems has come up with one answer – a hardware link that uses the RS423 serial port to move the files.

The system, known as Comkord, consists of two ROM chips – one for each machine – containing the transfer software, plus the cable.

The two machines are connected directly, with the software taking the files from the disc or tape attached to one micro and moving them automatically to the storage system of the other machine.

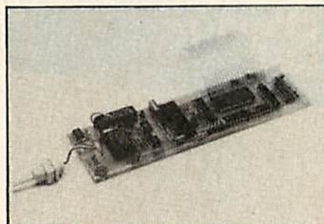
Network users can already do this fairly easily, so Comkord is aimed mainly at educational and institutional users without networks. The outfit for two computers costs £52.

Modem fits inside Master

After over a year of waiting, an internal modem has finally arrived for the Master – not from Pace, but from Beebug.

Pace started talking about an internal modem soon after the launch of the Master. The micro has a space between the main board and the power supply specially for such a device, although this is now taken up by the battery packs which replaced the original faulty lithium cell. The Master also has special connections on the board for a modem.

Pace ran into trouble with its design, and apparently lost interest, so it's been left to Beebug to fill the gap. The new modem, which should be available around now, offers both tone and pulse auto-dialling, auto-answer and call monitoring through the Master's internal loudspeaker.



At last – a Master internal modem

The modem will operate at 1200/75 and 300/300 baud, and costs £119 with software.

Acorn MD Brian Long resigns

Brian Long, managing director of Acorn for the last two years, has resigned unexpectedly.

The abruptness of Long's departure is underlined by the lack of a successor. In a terse press release on October 22, Acorn announced that Bruno Soggiu, the current company chairman, will take over his executive responsibilities.

The move came as a surprise to the industry. Although the interim financial results announced that month showed a £1.6m loss for Acorn, these were seen only as a slight setback, given the high expenditure on the Archimedes.



Long: unexpected decision

Arc graphics system

Millipede now has a version of its Prisma 3 professional graphics system running on the Archimedes.

The Prisma 3 was launched at the *Acorn User* show in August. It allows high speed, high resolution graphics and animation, with 256 colours on screen chosen from a palette of 17 million.

It will probably be next year before the Arc version is available, but a development system is already up and running and the company sees no problems in porting software over to the new machine.

The Archimedes version uses a special podule, and runs around 10 times faster than a Master-based system, with some commands being executed up to 50 times faster.

Boss beating

The latest business simulation from RBRC is *Beat the Boss*. It's nothing to do with managerial flagellation, but is in fact an educational program in which students have to run a fictitious company. The price is £34.50.

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Son of Genie

Yet another version of *Genie* has popped up. Following the success of the original package and the Master cartridge version, Permanent Memory Systems has produced the *Genie Junior* package.

It has all the same pop-up features as the original – notepad, address book, diary, calculator and so on. The main difference is that it uses a disc for storing data instead of battery-packed RAM. At £25 it is also £55 cheaper.

The *Genie* code has been split between the disc and a single ROM chip. The program works with most disc filing systems. PMS says it will have hard disc, network and RAM disc versions ready soon.



***Genie:* now on disc**

Meanwhile, PMS has made the original *Genie* compatible with the Master 512. That's useful as *Sidekick*, the MS-DOS package which started the fashion for pop-up utilities, refuses to work with the 512.

Micro Librarian is boon for bookworms

Keeping track of library books is a logical use for a computer, and a program for doing just that has appeared.

Schools are the main target for *Micro Librarian*, from Arnold and Plant. The program is essentially a database with complex reporting facilities. It can tell you which books are out, when they're due back and how many times each title has been borrowed.

As it stands, the program is capable of handling 12,000 books and 2000 borrowers, which should be adequate for even the largest school libraries.

According to the company, *Micro Librarian* is not so much a computer program as 'an ongoing research scheme'. What that means is that the company will be issuing regular updates to the software, with extra features and compatibility with other filing systems.

The software is distributed by Arnold and Plant at a price of £96.60.

BBC user group in India

India has now another BBC micro user group. Calling itself Beebaid – no relation to the software package – the group already has around 100 members and hopes to increase this to 500 by the end of the year. It hopes to market hardware and software, both in India and the UK. Contact: Amit Jalan, 47 Gulmohur Colony, Indore, Madhya Pradesh, India.

3-D turtles set to take off

Logotron is using the BETT 88 show for the official launch of its 3-D Logo package. Previewed at the last *Acorn User* show, this extension module for Logotron Logo allows the turtle to be moved in three dimensions, and adds pitch, roll and yaw commands. The British Education and Training Technology Show is at the Barbican, from January 20-23.

THE COMMS COLUMN

■ Micronet has changed the status of its Bizznet pages, the section devoted to business topics. Now even non-Micronet Prestel subscribers can read them, although an additional time charge of 4p a minute will be levied. Micronet subscribers will also be charged (page 92 will show the charge), but then be given 100 per cent discount on their bills. Although such users are obviously known to the Prestel billing computer, it is far too difficult, it would seem, to not apply the original charge.

■ Micronet is also getting into teleconferencing, with closed chatlines managed by users planned to start shortly. Some will run through 80-column gateways and will be similar to traditional special interest groups or bulletin boards.

■ There are signs that the Archimedes is being taken seriously by people who previously showed little interest in Acorn machines. Brian Smith mailboxed me to say that he is the moderator of the CIX Archimedes conference. For those of you who don't know what CIX is, see below. The teleconference is for serious Archimedes users and will concentrate on programming topics.

■ The Compulink Information Exchange (CIX for short) is an interesting commercial bulletin board system running in Guildford, Surrey. It is modelled on the US BIX systems by *Byte* magazine, and hosts a number of interactive conferences – each with a 'moderator', a volunteer who trys to keep the conference going in the right direction.

The CIX system is predominantly used by owners of the major American micros such as Amigas and PC compatibles. This is an area of increasing interest to Master 512 owners, but now the ordinary BBC micro and the Archimedes are catered for too. The discussions are quite high-level and very different in tone from the usual forums like Micronet Chatlines.

CIX is run by Frank Thornley on (0483) 573338 (all speeds to 2400 baud, scrolling). You can have a look at the system for free, but membership is £3.50, plus a noticeable but not excessive time charge of £1.00 per hour.

■ A new goody from Telecom Gold, for anyone left who can still afford, it is personalised telex numbers. This is, like the file transfer software, initially only available to corporate members (the 'first-class compartment' of the service). The advantage of the facility, of course, is that you can pretend to your customers that you have a real telex machine instead of merely being one of many using the number 265871 MONREF G.

■ On-line multi-user games (MUGs) have sprung up all over the place in the last few years, but unlike the classic Essex University MUD, most games today carry hefty on-line charges. It's a refreshing change therefore to hear of a game that's completely free except for the cost of the phone call. Comms enthusiast Glen Collins tells me about Mirrorworld, a MUG run from deepest Surrey on various BBC micros which provides all the facilities of the subscription MUGs, plus extras such as a facility where you can chat to other callers outside of the game. Mirrorworld is on (0883) 844164.

David Atherton

Dates for your diary

November 10-12 1987
New Technology in Training Exhibition at Novotel, Hammersmith, London. Further details on 01-727 1929.
November 10-12 1987
The *Mac User* Show at the New Horticultural Hall, Victoria, London. Details on: 01-486 1951.
November 13-15 1987
The *Electron User* and *Micro User* Show at the New Horticultural Hall, Victoria, London. Tel: 061-456 8383.
November 17-20 1987
COMPEC '87 at the Olympia Exhibition Centre, Kensington, London. Further details on 01-891 5051.
December 6 1987
North of Scotland Science and Technology Regional Organisation, The Music Hall, Aberdeen. Telephone Dr Glasser on (0224) 272952.
January 20-23 1988
British Education and Training Technology Exhibition at the Barbican Exhibition Halls, London. Tel: 01-404 4844.
January 19-22 1988
The *Which Computer?* Show held at the National Exhibition Centre, Birmingham. Details on 01-891 5051

Blunderbox roundup for 1987

For those of you who don't have all your back issues of *Acorn User* immediately to hand, here's a round up of the blunderboxes we've published in the last six months.

There were minor errors in the May issue's listings. First, Joe's Jottings listing 2 in the yellow pages, line 850 should read:

```
850 n=INT(2^(INSTR("
dsqcmsb",nm$)-1))
```

Also line 450 of the Convdat program should be modified to say:

```
450 dataline=790+50*
(char%-65)+10*L%
```

There was an error in the Joe's Jottings calculator listing in June's yellow pages. Line 320 should be:

```
320 IF k=1 PROCcl:EN
DPROC
```

This change allows the clear button on the calculator to work properly.

In July, the problem afflicted Copyfiles-II. There should have been a comma between the parenthesis and 'file$' in line 610:

```
610 DIM dir$(31),fil
e$(31)
```

And line 900 should read:

```
900 IF key$="1" THEN
system$(out)="ADFS":l
ink$="_"
```

August's Interrupting Basic program listing 1 has a checksum that is only correct for model B micros. If you had trouble running this listing, trying changing the following lines to:

```
420 checksum=&C0F0
510 checksum=&C582
600 checksum=&C0DC
3800 FOR loop%=code%
TO &ABC
```

In August's Hints & Tips the key sequence for condensed mode should be CTRL-B, CTRL-A, CTRL-O, CTRL-C.

There was a problem with one of the First Byte listings in the August issue too. Line 120 in Tessie Revivis' First Byte listing 3 should have read:

```
120 PRINT "Result is
";?first
```

Also, the September First Byte listing 3 contained an error. Line 160 should be:

```
160 PRINT ~?addr
```

and line 140 should be deleted. You should now find this prints out the call parameters properly.

October's Hints & Tips listing 1 is a little difficult to type in. In line 1300, the end of the line should read:

```
("SAVE "+name$+" 900 +
FF 400")
```

ADFS users will have to create a directory P before running this listing too. Listing 2, the spooled file replayer will work better in some cases if line 520 is replaced by:

```
520 JSR &FFEE
```

The checksum in line 780 then becomes &2E1E. The modified *PRINT command will now replay graphics files much better.

The checksum in October's Acorn Forum listing 5 applies only to the BBC model B. If you have a different computer, change line 1370 to say just '=TRUE'.

Hints & Tips listing 1 in the December issue was unreadable in some copies of the magazine. Line 80 should read:

```
80 FORN%=33TO255
```

And finally, there are two errors in the yellow pages for *this* month (that section of the magazine is printed in advance of the other parts). The checksums for Joe Telford's PACK and UNPACK programs should be corrected in the following way:

PACK program (Joe's Jottings listing 2)

```
1160 FOR I%=&900 TO &9B9
1190 IF P%<>23135 THEN P
RINT "Check listing":END
```

UNPACK program (Joe's Jottings listing 3)

```
980 FOR I%=&900 TO &99B
1010 IF P%<>18459 THEN P
RINT "Check listing":END
```

DISC TRANSFER SERVICE

Acorn User is proud to announce another service to readers. We are now able to transfer the contents of unprotected DFS or ADFS 5.25-inch discs on to 3.5-inch ADFS discs. The cost is £5, or just £3 if you send us a blank ADFS formatted 3.5-inch disc.

We are not, for obvious reasons, able to copy protected software. We are also unable to make more than one copy of each disc. The service is entirely confidential, although it is readers' own responsibility to ensure that they are not in breach of regulations on confidentiality and data protection.

Please include sturdy return packaging for both discs, plus postage, and ensure that all discs are clearly labelled with your name and address.

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Competition winners

The copies of Firebird's *Sentinel* game from our June competition were won by: Mark Lambert of Washington, Tyne and Wear; A I Livingstone of Milngavie near Glasgow; Torfi Olafsson from Reykjavik, Iceland; Bong Ui Yi from Dubai; N M Mathau from Monmouth in Gwent; Hywell Steel of New Malden, Surrey; Jonatham Britton from Warrington; Francis McCaffery of West Calder, West Lothian; Mr A B Venham from Chichester, Sussex; Dominic Newman from Exmouth in Devon; Mr U J Spanner of Seaford, Sussex; Richard Koten from Harrow, Middlesex; Philip Smithson of Thetford, Norfolk; Craig Barrett of Hornchurch in Essex; Tim Ward from Boston in Lincolnshire; Andrew Eakins, Reiling Mill, Northumberland; Tang Kok Vai, Kowloon, Hong Kong; Vernieuwe Luc from Ostende, Beligum; Paul Mama, Middleton, Manchester and W Cheung from East Molesey in Surrey.

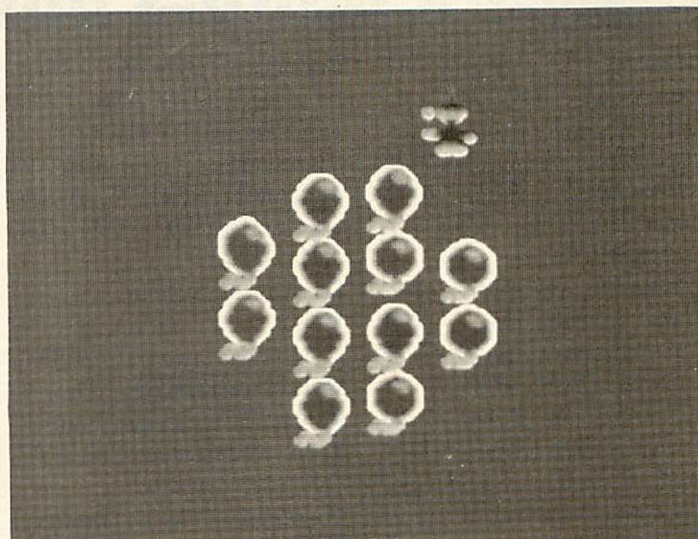
The five winners of our fifth anniversary competition run in the July issue won prize software bundles consisting of *AMX Stop Press*, Logotron Logo, Superior's *Elite*, the Island Logic Music System and *ViewSheet*. They were: J M Shepherd of Ilkley, West Yorkshire; S L Hart, Pinner, Middlesex; G Arnold of Tadworth in Surrey; Craig Dyke from Solihull, West Midlands; and Steve Tweedale, Bacup, Lancashire.

Alan Dunn from Liverpool, Merseyside and H Remegan from Delf in the Netherlands won copies of Computer Concept's *SpellMaster* in the August competition.

Finally, the two lucky winner of PMS' *Genie* package in our September number base competition were S Birch from the Wirral, Merseyside and K Padgett of Coltishall, Norwich, Norfolk. A consolation prize of an *Acorn User Portfolio* disc went to Ms L Sharp, who bravely hand delivered her entry on October 15 , the closing day of the competition, as violent storms swept over London and the south east.

All winners have already been informed by post.

Next month's issue



Wizards and Ferrets* – free with January's *Acorn User

January's *Acorn User* is packed with features and listings to while away the dark winter nights and help you get through Christmas and the New Year.

Martin Phillips describes a mailmerge program for *Wordwise Plus*, to take the tedium out of writing all those thank you letters.

Communicate with your BBC micro using the television's remote control. Joe Telford shows how to interface the micro with an infra-red remote control handset.

And as its holiday time, we've got an infuriating machine code game *Wizards and Ferrets* for you to type in. Smooth sprite movement, a high score table and some clever programming techniques make this game the most playable yet.

And our education team look forward to the coming new term with a feature on computers in CDT teaching.

POST A PROBLEM

Acorn User has a guaranteed fast reply service for enquiries. Your answer will be returned within 10 working days for just £3 (includes VAT), or your money back.

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Please note: debugging readers' programs or those from other magazines is a complex task and we cannot guarantee to give a full solution. Unless the problem can be spotted quickly, the service will only be able to make general comments or suggest a strategy for the reader.

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Advanced Computer Products, 6 Ava House, High Street, Chobham, Surrey GU24 8LZ. Tel: (0276) 76545.
Amplinex, 26 Arbor Lane, Winnersh, Berks RG11 5JD.
AMS, 166-170 Wilderspoll Causeway, Warrington WA4 6QA. Tel: (0925) 41351.
Arnold and Plant, 31 Market Street, Whaley Bridge, Stockport. Tel: (06633) 2416/3655.
BBC Soft, Woodlands, 80 Wood Lane, London W12. Tel: 01-576 0548.
Beebug, Dolphin Place, Holywell Hill, St Albans, AL1 1EX. Tel: (0727) 40303.
Clares Micro Supplies, 98 Middlewich Road, Northwich, Cheshire CW9 7DA. Tel: (0606) 48511.
Datathorn Systems, George House, 50 Spring Grove, Loughton, Essex IG10 4QD.
Hybrid Technology, Unit 3, Robert Davies Court, Nuffield Road, Cambridge CB4 1TP. Tel: (0223) 316910.
Logotron, Dales Brewery, Gwydir Street, Cambridge CB1 2LJ. Tel: (0223) 323656.
Mertec Computer Products, 35-36 Singleton Street, Swansea, West Glamorgan SA1 3QN. Tel: (0792) 467980.
Micronet, Durrant House, 8 Herbal Hill, London EC1R 5ES. Tel: 01-278 3143.
Microvitec, Futures Way, Bolling Road, Bradford, West Yorkshire BD4 7TU. Tel: (0274) 390011/726500.
MUSE, PO Box 43, Houghton on the Hill, Leicester LE7 9GX. Tel: (0533) 433839.
Minerva Systems, 69 Sidwell Street, Exeter, Devon EX4 6PH. Tel: (0392) 37756.
Nidd Valley, 4AA9 Thorp Arch Trading Estate, Wetherby, West Yorkshire LS23 7BJ. Tel: (0937) 844661.
National Interactive Video Centre, 24 Stephenson Way, London NW1 2HD. Tel: 01-387 2233.
Permanent Memory Systems, 38 Mount Cameron Drive North, St Leonards, East Kilbride G74 2ES. Tel: (03552) 32796.
Pineapple Software, 39 Brownlea Gardens, Seven Kings, Ilford, Essex IG3 9NL. Tel: 01-599 1476.
RBRC, Guild House, 32 Worple Road, Wimbledon, London SW19 4EF. Tel: 01-946 8641.
Resource, Exeter Road, Off Coventry Grove, Wheatley, Doncaster DN2 4PY. Tel: (0302) 63800/63784.
SJ Research, 108 Mill Road, Cambridge CB1 2BD. Tel: (0223) 69927.
Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX. Tel: (0532) 459453.
Tubelink, PO Box 641, London NW9. Tel: 01-205 9393.

Arc art contest

Archimedes owners – can you do better than this? If you can draw a picture of your own using Clares' new Arc package, *Artisan. Acorn User* will publish the best picture we receive each month, and the artist will get a lockable box of 20 3.5-inch discs as a prize.

The best picture overall will be turned into a real painting by Clares' artist in residence, Jon Warmisham. The judging for this will be done by *Acorn User*'s editor, Tony Quinn, Jon Warmisham and Dave Clare.

Clares' *Artisan* is the first screen-art program for the Archimedes. If offers full control over all the Archimedes' graphics facilities.

Pictures can use up to 16 colours, which can be picked from any shade the Archimedes can produce.

There is a pixel editor and impressive move and copy facilities. These allow any shape to be dragged across the screen with the mouse. Any shape can be defined as a sprite, used as a brush for drawing, and even saved in a sprite file to use with other programs.

Your entries should be drawn using *Artisan,* and saved on 3.5-inch disc using the 'screensave' option. Send your entry to Clares' *Artisan* Competition, 98 Middlewich Road, Northwich, Cheshire CW9 7DA. If you want your disc returned, then enclose return packaging and stamps.



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Phillips CM8833
14" CVBS and RGB medium resolution colour monitor. IBM PC compatible. Fast blankup to enable superimposing. Stereo Audio. Ear phone socket. 600 dots x 285 lines vertical **£269.00**
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High Resolution colour monitor with several unique features, at an affordable price.
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Source SD3545S Combo dual 5¼" and 3½" drives with P.S.U. **£249.00**

Winchester Disk Drives

WINCHESTER DISK DRIVES

Source HD20 Twillstar's 20 Mbyte winchester drive including Acorn DFS ROM complete with P.S.U. **£499.00**
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Printer/Computer sharers.

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Draft print to 180cps. NLQ text to 25cps. Two correspondence fonts. Pull-feed tractor supplied as standard. IBM character set. Integral 3K buffer. Graphics capability. Push-button controls. Standard centronics interface.

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Fast 300cps draft print. Correspondence quality to 50cps built in. High resolution graphics. Powerful 8K buffer. IBM character set. Advanced front control panel. Choice of wide or narrow carriage. Standard push-feed tractor. Short tear-off feature. Two-stage automatic paper loading. Reverse paper feed.

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STAR ND10	£349.00
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Font Cartridge	£40.00

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Ribbon	£5.50

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Same as MP200 with 136 columns **£318.55**

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120/25cps 80 column Centronics IBM Parallel

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160/40cps 80 column Centronics IBM Parallel

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CITIZEN MSP15E **£379.00**
160/40cps 136 column Centronics IBM Parallel

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PREMIER 35 **£569.00**
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Colour 216/72cps 136 column Centronics/IBM Parallel

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P6/CP6 Cur Sheet Feeder	£104.00
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P7/CP7 Bi-directional Tractor	£138.00
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DAISYWHEEL

PANASONIC KX-P3131
A Fully Formed Serial Impact Daisywheel printer with print speed of 17cps. Diablo compatible print wheels. Print pitches available are: 10, 12, 15 and proportional spacing. Standard friction feed and optional tractor. Paper width 13.5 inches. Standard Centronics optional RS-232C. Built with 6K text buffer expandable to 32K buffer. **£289.00**

BROTHER HR 20
The new Brother Daisywheel HR 20 8K standard buffer upgradable to 16k. Comes standard with serial and parallel port **£389.00**

JUKI Daisywheel
Juki 6100 **£329.00**

NEW MP26 Daisywheel
MP26 A feature rich very quiet printer. Universal compatibility with almost all personal computers at an unbeatable price. Speed: 26 cps. 132 columns Diablo 630 compatible **£249.00**

Optional Tractorfeed	£95.00
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MP40
A very fast, quiet printer with features compatible with virtually all computers at a fantastic price. 40 cps, 132 column, diablo 630 interfacew, parallel interface, built in standard RS232 optional **£355.00**

GAKKEN GPR-2000
Print speed of 18 characters per second. Fully Qume compatible. Takes Qume exchangable Daisywheel and ribbons. Selectable 10,12 & 15 pitch. Supports proportional spacing. Standard friction feed. Tractor/cut sheet feeder and serial interface optional. **£169.00**

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You can purchase any of the items listed. All you have to do is write your requirements on a sheet of paper, and we will despatch your goods within 24 hours, subject to availability. Please add the following amounts for Postage and Packing.

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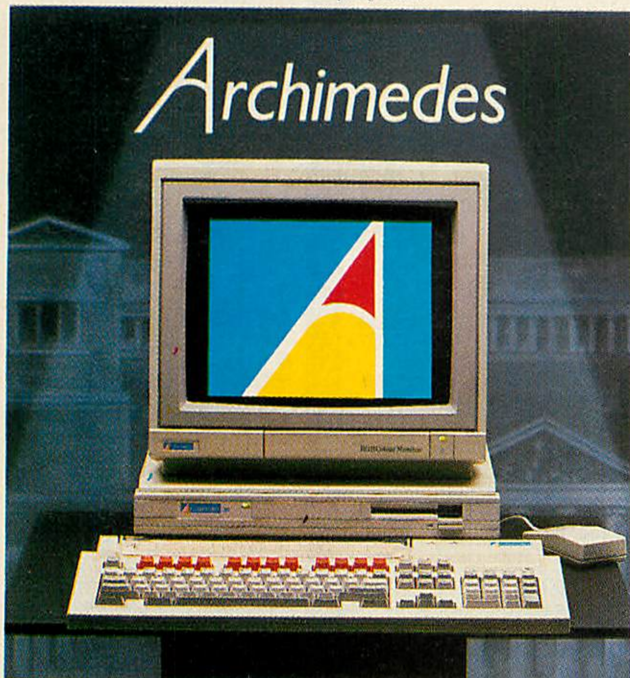
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†Home/Small Business Category of the British Microcomputing Awards.



Model shown here is the Archimedes 310 with colour monitor and includes Mouse.

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- The huge potential of Archimedes doesn't stop there. The 310M with its built-in PC emulator can run Lotus 1.2.3,* D BASE III,* MS-WORD,* and other popular business programs available under MS-DOS.*
- With prices starting at £749 exc. VAT for the 305 with mono monitor and rising to £1035 exc. VAT for the 310M with colour monitor, the Archimedes 300 series represents unparalleled value for a computer system of such capability.

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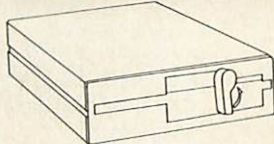
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Interest free credit is available on all Archimedes systems during the period 1.10.87 to 31.12.87. Maximum period of credit 12 months. Subject to status.
Written quotation available on request from participating dealers who are licenced credit brokers.

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VIGLEN DISK DRIVES



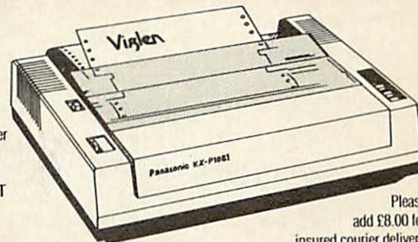
Simply plug a Viglen disk drive into your BBC B (fitted with DFS), B+, or Master micro and immediately benefit from 400 or 800 KB of extra data storage capacity.

Stock Code	Description	Price inc. VAT	
VPD 0241	400K Single Drive, No PSU	£119.95	NOW WITH 3-YEAR WARRANTY
VPD 0246	400K Single Drive, + PSU	£134.95	
VPD 0243	800K Dual Drive, No PSU	£222.95	
VPD 0248	800K Dual Drive, + PSU	£249.95	
VPD 0249	800K Bridge Unit + PSU	£264.95	
VPD 0250	5.25" + 3.5" Combined + PSU	£249.95	
SPO 14	Single 400K 40/80T Drive	£ 99.95*	SPECIAL OFFER
SPO 19	Dual 800K 40/80T Drive	£189.95*	

* These two models are offered with 12 months warranty
Please add £8.00 for insured courier delivery.

PANASONIC PRINTER KIT

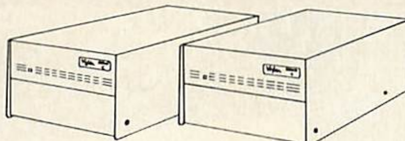
The Panasonic KX-P1081 comes complete with £45.00 worth of accessories FREE including tractor feed and roll feed units with paper, printer cable, and a specially designed metal printer stand.
Features include:
* 120 cps draft printing, 24 cps NLQ
* IBM and Epson compatibility through dip switch settings
* Prints 80 columns on A4 cut sheets, continuous stationery or roll paper
* 9×9 draft and 18×23 NLQ



Stock Code	Description	Price inc. VAT
SPO 79	Panasonic KX-P1081 plus accessories	£189.95

Please add £8.00 for insured courier delivery.

VIGLEN WINCHESTER DISKS

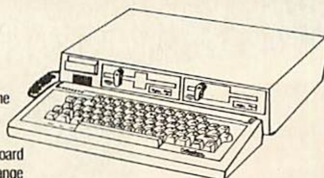


Plug-in 20 to 112MB of extra storage with the Viglen Winchester system.

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V0155	VB40 40MB Viglen Winchester	£1045.00
V0156	VB56 56MB Viglen Winchester	£1119.00
Drive 1 Second Drive		
V0160	VB120 20MB Drive 1 Winchester	£ 549.00
V0162	VB128 28MB Drive 1 Winchester	£ 599.00
V0165	VB140 40MB Drive 1 Winchester	£ 819.00
V0167	VB156 56MB Drive 1 Winchester	£ 899.00
V0157	20MB Tape Streamer Backup	£ 724.95

PROFESSIONAL CONSOLE UNIT

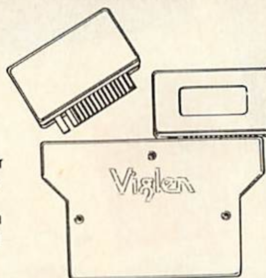


Give your BBC or Master micro a professional PC-look by replacing the existing lid with this smartly styled package which can house two disk drives. Complete with separate keyboard case and connecting cables. A full range of accessories is also available.

Stock Code	Description	Price inc. VAT
V0851	Viglen Professional Console Unit for the BBC micro	£49.95
V0861	Viglen Master Console Unit for the Master micro	£59.95

Please add £8.00 for insured courier delivery.

ROM CARTRIDGE SYSTEM



Designed by Viglen for use with the BBC B or Master micros, the Rom Cartridge System allows a range of Rom software to be used and interchanged easily without fear of damage to the delicate pins. The system is simple to fit and requires no soldering.

Stock Code	Description	Price inc. VAT
V0560	Viglen Rom Cartridge System for BBC	£12.95
V0559	Viglen Rom Cartridge System for BBC (low profile)	£12.95
V0550	Viglen Rom Cartridge System for Master	£14.95
V0561	Single Viglen Cartridge	£ 3.99

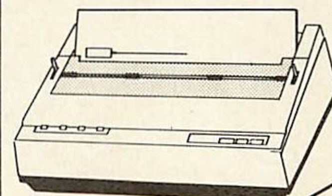
Please add £2.50 for postage and packing (£00.50 for single cartridge).

DAISYWHEEL PRINTER

The Panasonic KX-P3131 daisywheel printer is Diablo-compatible and utilises bi-directional logic seeking techniques to produce letter quality print at a rate of 17 characters per second (cps). Friction speed provides really efficient paper handling, whilst tractors are available as an option.

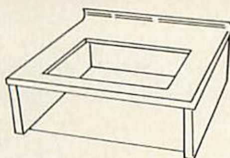
Stock Code	Description	Price inc. VAT
V0400	Panasonic KX-P3131 Daisywheel Printer	£299.95

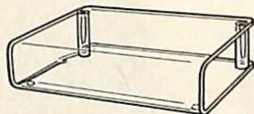
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PRINTER STANDS





Viglen's printer stands are available in	Price inc. VAT
clear perspex, 80 col.	£19.95
136 col.	£29.95
high-impact ABS plastic colour-matched to most printers, 80 col.	£14.95
black metal finish	£ 9.95

Viglen's printer stands cater for 80 and 136 column printers and allow continuous stationery to be stored underneath.
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Simply fill in the coupon or write to us with your requirements enclosing a cheque/postal order or your credit card no. for the total amount. Don't forget to add the cost of delivery. Allow 7 to 10 days for delivery. Credit card holders may order by telephone on our sales hotline 01-843 9903 (8 lines). Orders from overseas should be exclusive of VAT (Please deduct 15% from the total cost).



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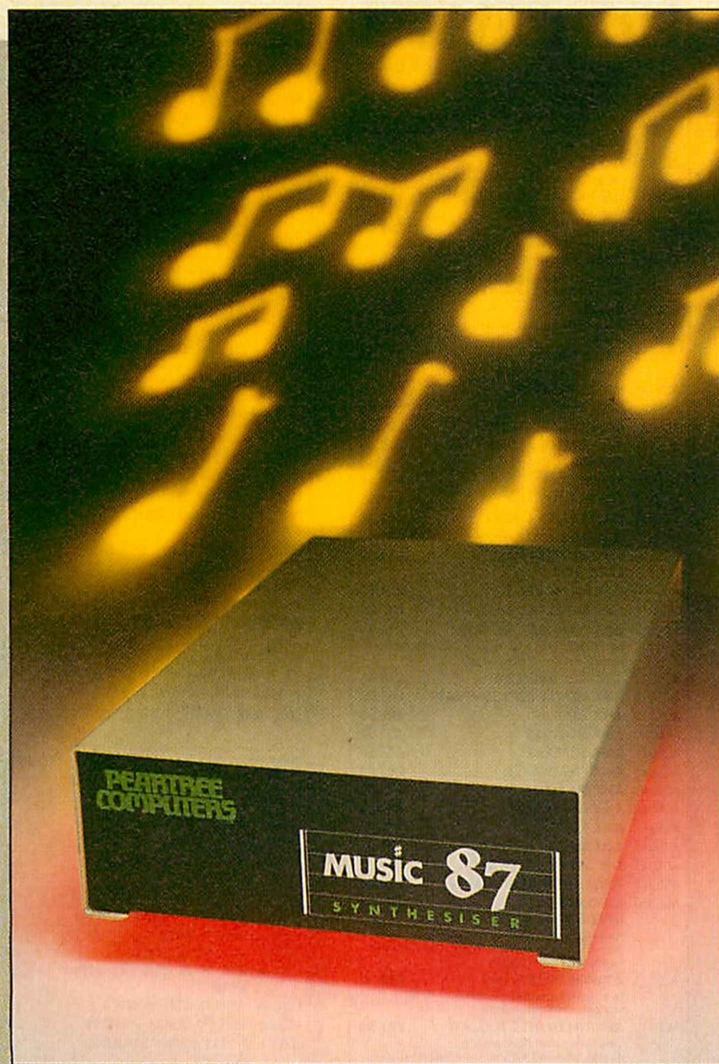
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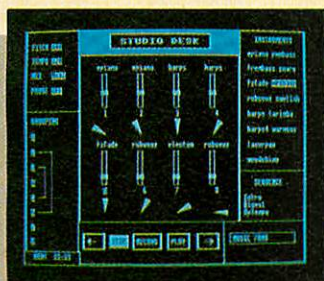
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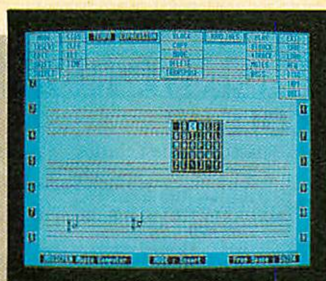
Peartree House, No 1 Blackstone Road, Stukeley Meadows Industrial Estate, Huntingdon, Cambs PE18 6EF. Telephone (0480) 50595



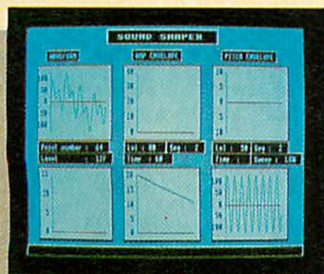
▶ PEP024



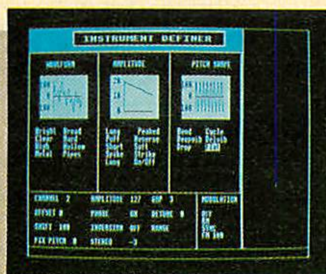
Studio Desk menu with mouse driven record, play, rewind options



Music Editor menu, light pen & mouse driven with complete menu options at top



Sound Shaper allowing you to create your own waveforms, envelopes, mouse, lightpen or keyboard driven



Instrument definer allows you to define your own instrument pitch, amplitude and wave forms

OVER 17000

visitors attended the 87 Acorn User Show. Most were amazed at the performance of the **MUSIC 87**. As a result we have been receiving hundreds of telephone calls from people wanting to know the differences and merits of the **MUSIC 87** synthesiser when compared to more expensive music synthesisers. Below is a table showing how the **MUSIC 87** compares to the Music 5000.*

9 good reasons to buy the **MUSIC 87** rather than the Music 5000.*

FUNCTION	Music 5000	MUSIC 87
Mouse driven	✗	✓
2nd processor compatible	✗	✓
Light pen driven	✗	✓
Full 32k EPROM	✗	✓
Waveform designer as standard	✗	✓
Ability to bypass AMPLE	✗	✓
Graphic representation of waveforms, envelopes and score	✗	✓
Music printout as standard	✗	✓
Expensive	✓	✗

Price	Music 5000.*	**MUSIC 87**
	£161.00	**£79.95**



MUSIC 87 software to upgrade your Music 500 or 5000 only **£39.95**

*Music 5000 is supplied by Hybrid Technology Limited

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ECONET

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ACH009	**ECONET SOCKET KIT**	£29.00
ACH010	**ECONET MODULE** Upgrade cartridge for Master 128	£43.00
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ACP006	**PRINTER SERVER EPROM** Allows BBC machine to be a printer server station	£39.00
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ACH039	**FILESTORE E01** Stand alone twin floppy file server unit Contains clock box, terminator, etc.	£819.00
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AKHTER

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ACH027	**SINGLE 40/80 DRIVE inc. PSU 400K MITSUBISHI**	£135.00
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ACP033	**BBC MASTER DUST COVER**	£4.50
ACP034	**BBC B DUST COVER**	£4.50

The Acorn Music 500

SYNTHESISER

Now available from **Peartree** the Acorn Music 500 for the BBC, BBCB+, Master 128

£49.00 excluding VAT.

only from PEARTREE ▶ **ACH034**

SOFTWARE

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ACS003	**INTER SHEET** 40, 80 and 105 column mode multiple spreadsheet	£42.00
ACS004	**INTER CHART** Built in Epson screen dump · Supports pie, line & bar charts	£30.00
ACS005	**INTER WORD** 80 or 105 column word processor · Continuous documents	£42.00
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ACS033	**SPELLMASTER**	£50.95

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ACS013	**VIEWSHEET** Acornsoft standard spreadsheet	£36.00
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ACS017	**VIEWINDEX** Automatically creates indexes, notes, page numbers	£13.00
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ACS181	**OVERVIEW** Includes all View family software	£86.00
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ACS055	**FORTH DISC**	£14.95
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ACS042	**AMX PAGEMAKER**	£43.00
ACs043	**AMX 3D ZICON**	£21.00
ACS044	**AMX DATABASE**	£21.00
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ACS046	**AMX MAX**	£17.00
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MON010	**KAGA KX 118 GREEN MONITOR** Clarity exceptional on BBC text	£99.00
MON011	**KAGA KX 119 AMBER MONITOR** (PUL)	£99.00
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PRT004	**EPSON LQ800 PRINTER** 24 pin dot mtrix · 180 CPS draft mode, 60 CPS NLQ mode · 7K buffer · Parallel interface standard · 80 column	£499.00
PRT005	**EPSON LQ1000 PRINTER** 24 pin dot matrix · 180 CPS draft mode, 60 CPS NLQ mode · 7K buffer · Parallel interface standard · 136 column	£699.00
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**Please Note
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LDS007	**BBC TO CASSETTE**	£2.25
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LDS011	**4 WAY MAINS TRAILING SOCKET**	£9.50
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MIS016	**DFS OPERATING SYSTEM MANUAL**	£6.95
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MIS024	**BBC ADVANCED USER GUIDE**	£16.95
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MIS006	**RIBBON FOR LX80 LX86**	£4.50
MIS007	**RIBBON FOR MP165**	£5.00
MIS008	**RIBBON KAGA KP810/ CANON PW1**	£5.95
MIS009	**RIBBON FOR EPSON FX RX/100**	£7.95
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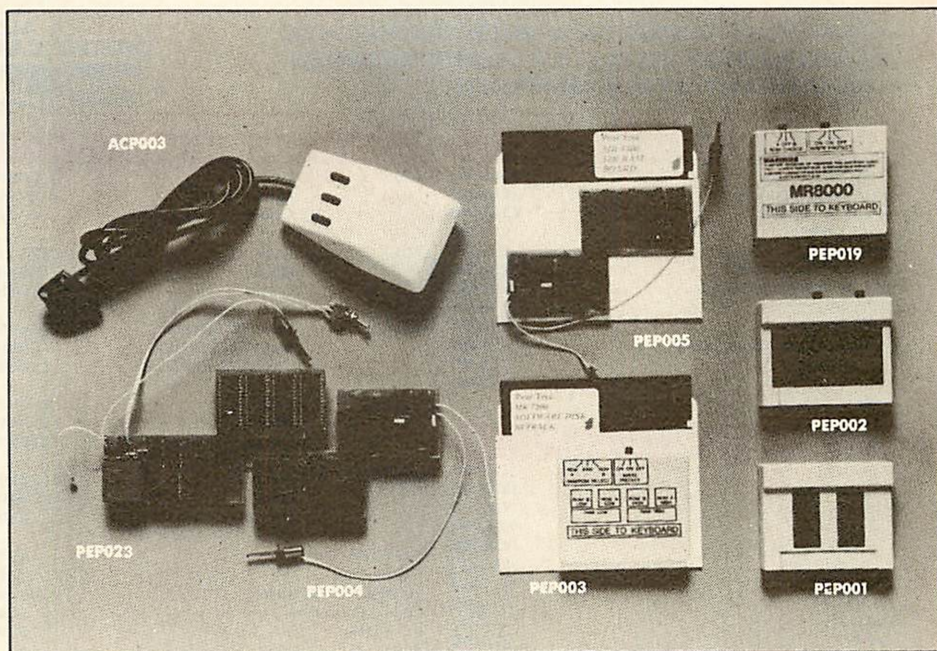
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Level 2 Software	£216.00	Filestore E20 (20Mbyte)	£721.00
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CS400	80T/DS	400K	£139.00
CS354	3.5"	400K	£119.00
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CD200	40T/SS	200K	£199.00
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CD358	3.5"	800K	£199.00

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MD802E	40/80	800K	** £219.00
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RML PERIPHERALS

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PC 1512DD Mono		£499.00
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PC 1640SD	Mono	£499.00
PC 1640DD	Mono	£599.00
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LETTERS

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MICROS IN MIDDLE SCHOOL

Sir, many congratulations on the Education section in *Acorn User*. I'm sure it has been useful, informative and interesting for many different age groups.

However, why not in future issues try to convince the governing bodies involved with secondary education that computers should not be something kept in a cupboard for GCSE computer studies students and teachers who want to practise arcade games? What about the children who move up from primary schools well advanced in computer literacy and eager to further their knowlege? Have they to wait with baited breath and fingers poised for the next three years, when they can finally choose computer studies as an exam option? By which time their interest may have been replaced with something else, such as vandalising telephone boxes!

Sad isn't it? Especially if the school is their only means of access to a computer and they are very keen.

Is it because the 'powers that be' regard time dreamed away in the pokey corners of the school library more important to our future generation than expanding on the thorough groundwork covered by many of our primary schools? Or is it because they lack the knowledge and numbers of qualified staff to cope with these computer 'whizz kids'?

Whatever the reason, I was wondering if *Acorn User* magazine or any of its readers could put forward any solution, for after all most schools own at least one of the mighty BBC machines. The end product could be that more students are interested in taking the GCSE course, and, more important, that more students pass.

And you never know, perhaps fewer telephone boxes will be vandalised!

Mrs V Rowsell
Cleveland

TUNEFUL ADDRESSES

Sir, I was interested to read the short article on Hybrid Technology in your *Acorn User* Show guide in the August *AU*.

I wasn't able to visit the Show, so please print the addresses of Hybrid Music Systems (as I am interested in the new Music 4000 keyboard), U-Music and EMR.



Crowds at the *Acorn User* Show

It would be interesting if you could write an article on music systems for the BBC B.

N Desforges
Formby

Hybrid Music Systems are at Robert Davies Court, Nuffield Road, Cambridge. U-Music are based at 17 Parkfields, London SW15 and EMR can be contacted at 14 Mount Close, Wickford, Essex.

***Acorn User* looked in detail at MIDI systems in the July 1985 issue, and April 1987 was a special edition with features on micro music.**

PROCESSING POWER

Sir, In connection with First Byte in July, surely a 'macro' is the term for a single machine code instruction, not a loop in which assembly code is compiled, as you suggested.

The processor translates each macro-instruction into a series of micro-instructions which are stored in its control store.

It is interesting to note that as most cheap processors have only a small amount of control store, macro-instructions are limited by the number of micro-instructions they can be made up of. Hence no multiply instruction is available on the 6502 processor!

Colin Main
Harpenden

The difference between a micro-instruction and a macro-instruction sometimes is just as you describe. The 'machine code' of the processor is macro-code, and each macro-instruction is executed as a series of micro-code steps. This is why processors take several clock ticks to execute a single macro instruction – it's often one tick for each micro-instruction. The micro-code is stored as part of the processor. However, this is not true for the 6502 chip. This is a 'hard-wired' processor with no micro-code level. The machine code instructions control the chip directly. Micro-code is used on more complex chips like the 8086 or 68000. Interestingly, one of the reasons the ARM RISC chip is fast is that it too is 'hard-wired' – there is no micro-code. All its instructions are built directly into the hardware.

TEAR-BAR TIPS

Sir, I have an Epson LX80 which I use with my Electron. The tractor feed on this printer does not have a tear-bar and so I set about providing one as Bob Panting did in June 87's Hints & Tips.

Initially I also came up with a device not unlike Bob's, making use of a hacksaw blade. However this was not a total success and so it was back to the drawing board. My solution was to make a hardwood bar (mine is a piece of beech), 345mm long by 20mm wide by 10mm thick and simply stick it to either side of the top of the rear of the tractor feed using some small sticky pads. An improvement would be to use a bar made from clear perspex.

I do, of course, rest my fingers on the bar when tearing the paper against it, as this avoids having to keep replacing the sticky pads.

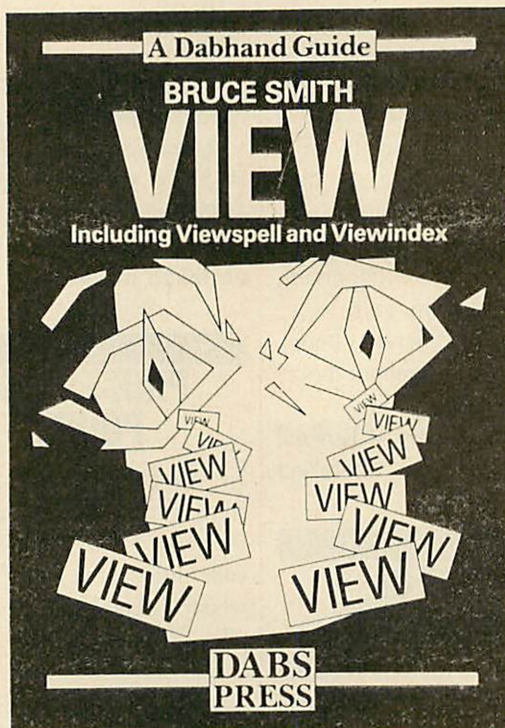
Thanks to you for a fine magazine and thanks to Acorn for a fine machine.

David C Barney
Retford

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THEME MUSIC

Sir, Here are a few tips for the use of the 'Theme' music editor from the April 1987 issue of *Acorn User*.

- When composing, tabulate the notes so that the beats in each voice are displayed to line up vertically.
- Don't leave envelopes out when first entering music. Even if they aren't the sounds you wanted, envelope markers can be used to locate yourself within the music.
- To play just one voice or section through, position the cursor on the first note you want played, and keep your finger on Return until you want to stop playing. There might be a slight hitch in the timing when the next 'page' of music is drawn.
- In the 'sustain' and 'slow fade' voices, where two notes the same pitch follow each other, it is often advisable to shorten the first note and insert a rest to prevent the notes being tied and sounding like a single note. For instance, a minim followed by a crotchet of the same pitch would become crotchet, dotted quaver, semiquaver rest, crotchet. This technique can also be used for elementary phrasing.
- Use a vibrato sound occasionally to bring the melody out more strongly.
- When paring down existing music to three voices, include the melody and the bass. Make the other channel a mixture of the rest of the parts, using the notes which give the music the most 'character' – usually accidental sharps, flats and naturals – and interesting pieces of timing (triplets, sequences of notes which give the music flow, etc).
- If all else fails and a piece of music doesn't sound quite right, remember your ears are the best judge!

Andrew Love
Hertfordshire

Thanks for the tips, and for the example music included with the letter. *Acorn User* is planning another music issue early in 1988.

57 VARIETIES OF ADVERT

Sir, In answer to the dozens of your readers who have written, our advertising agency believes that the bar code surrounding our advertising decodes to a number representing Heinz tomato soup.

Sorry if you were expecting it to be something a little more profound!

Brian Beattie
Nebulae Computer Supplies

The cryptic advertisement

HITTING THE BAR CODES

Sir, I am in the process of setting up a business and intend using a BBC Master 128 for stock control, invoice printing, etc, enlisting the help of a bar code system for monitoring stock levels and sales trends.

The problem I seem to have at the moment is the apparent lack of information regarding bar codes and also business software that is suitable for bar code operation.

I am absolutely desperate for any information on this subject and would be extremely grateful for any advice you might possibly be able to give.

A F Richardson
Nottingham

The bar code reader once supplied by *Acorn User* is still manufactured and marketed by PMF, PO Box 5, Romford Essex RM3 7LH. This unit now contains updated software in a ROM. Further details on (04023) 48956.

STAR MISMATCH

Sir, I am writing in response to a letter from A Cox in the November issue, regarding Star printers and dumps.

The problem with the older Star printers, the Gemini and the SG10, is that they are not fully Epson-compatible in two ways. First, the code for quad density graphics on the Star is 122 whereas on the Epson it is 90, and second the finest line feed on the Star printers is 1/144th-inch as opposed to the Epson which is 1/216th-inch. This is why the gappy dump was produced, as the line feed size set in the dump was assumed to be in 216ths of an inch steps.

We have managed to modify dumps and NLQ ROMs to work on the early Star printers, but it is an awkward process.

A J Hodge
A&G Electronics

A modified Star screen dump is available for £5 on disc from A&G Electronics, 14 Hurstwood Avenue, Bexley, Kent DA5 3PH.

It all goes to show there are different degrees of Epson compatibility. If readers know of any other incompatibilities, where printers claim to be Epson-compatible but aren't, then let us know. We'll publish a summary in a future issue of *Acorn User*.

NO DUMMY AT SORTING

Sir, After refering to Joe Telford's October 1987 article on sorting, your readers will be familiar with the simple technique of interchanging two variables using a third as a temporary store. However, I thought your readers may be interested to know that in theory it is possible to perform the same process without the use of a dummy variable.

These two listings will interchange the variables A and B but without the use of an intermediate store:

```
100 A=A+B
110 B=B-A
120 A=A-B
```

```
100 A=A*B
110 B=A/B
120 A=A/B
```

Of course, these ideas might not be used in practice as rounding errors would sometimes produce the wrong results.

Peter McDonald
Scunthorpe

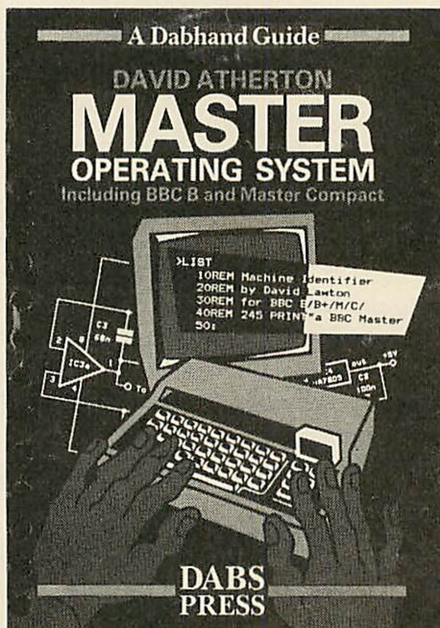
The first of Peter's ideas is quite often useful when memory is tight, though as he says the second is prone to rounding errors, and it can't be used with integer variables. Neither technique can be used with strings, of course, so they couldn't be used with Joe Telford's sorting programs. A further technique is sometimes used too:

```
100 X=5
110 Y=10
120 X=X EOR Y
130 Y=Y EOR X
140 X=X EOR Y
150 PRINT X, Y
```

DABHAND GUIDE

ACORN USER OFFER

Master operating system guide



This is the only advanced user guide for the Master 128, from Acorn expert David Atherton. It also covers the BBC model B+ and Master Compact, and there is much for the model B and Electron programmer. David Atherton has produced a definitive reference work which serious programmers cannot afford to be without.

The book covers all features of the Acorn MOS, including all 'star' commands on all models, 65C12 opcodes (including Rockwell additions), all new Osbyte, Osword and other system calls, sideways and shadow RAM programming, ROM service calls and header codes, never before published complete Tube documentation and full Master series filing system calls. There is also a complete list of differences between the various Acorn machines.

The book contains example programs such as a disc ID reader, an on-screen clock ROM, a shadow screen data buffer, and many others. An additional programs disc contains all the programs from the book, plus a full-feature memory editor and complete utility ROM!

Please send me:

________ copies of *Mastering Operating System: A Dabhand Guide* at £12.95.

________ copies of book and 5.25-inch disc at £16.95 (£1.00 discount)

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DRAWING CONCLUSIONS

Sir, I would like to draw your readers' attention to a number of points raised by Peter Eggleton's article Better By Design in October's issue.

First, visual approaches to program design are particularly prone to getting 'out of step' with the source code of an evolving program, as designs must be re-drawn (usually by hand) as changes are made.

Second, the Jackson design technique is a *data driven* methodology (although this was not made apparent in the article). Any serious structured programming methodology must be concerned with the modelling of data structures and the operations that may be performed upon them. It is regrettable that this most fundamental aspect of program design was ignored.

Finally, using one box per source code statement forces the designer to make implementation decisions too early as levels of abstraction are lost.

Mr Eggleton is right when he says structured programming doesn't just mean not using GOTOs, but it doesn't just mean drawing boxes either! Readers interested in the design and implementation of 'real' programs may like to read *Software Engineering* by I Somerville (Addison-Wesley) or any of Wirth, Hoare or Dijkstra's excellent works.

Gary Philips
Solihull

RING IN THE NEW

Sir, With due respect to the Rev McMullon (Letters, October), I am somewhat tired of reading and hearing from people bemoaning the arrival of a company's new computer when it knocks a previous model out of the limelight.

As the proud owner of a trusty model B (issue 2, now nearing its sixth birthday) I welcome the Archimedes onto centre stage of the micro world, even though ownership of one at the current price is beyond my wildest dreams.

I would be pleased as Punch if Acorn would produce a coprocessor for my Beeb, let alone the Reverend's Master. However, I cannot blame Acorn for investing in the design and production of the new systems architecture at the expense of outdated predecessors. The Master was a less formidable leap from the original BBC but many Beeb owners felt they needed one and took advantage of dealers' part-exchange offers to procure one. Already Masters have become part-exchangeable for Archimedes.

Rev McMullon's argument in favour of an ARM add-on for the Master seems to make good sense, but, to make an analogy, would he really expect Ford to produce a DIY kit to transform his old Anglia into a 4×4 Sierra Cosworth?

Anyway, I am confident that, like Fords, old Beebs will never die.

Peter Draper
Atherstone

COMPACT ABANDONED

Sir, It is less than a year since the Master Compact was introduced, yet I feel it has been abandoned by Acorn, software producers and *Acorn User*.

Logotron doesn't do *Xor* because it wouldn't sell enough copies, and the same is apparently true of *Aviator*.

Robert Miller's review of *Xor* in September rubs salt into the wounds. He doesn't even mention the fact the disc is not available for the Compact. And most of your own discs aren't in 3.5-inch format.

Come on you people: if you don't offer the goods, you won't sell any. Make 3.5-inch discs for the Compact (you can even charge a little more for them) and I think you'll find there is a demand.

David Raley
Essex

Readers can check which listings in *AU* are relevant to their micro by looking at the compatibility chart on the first yellow page (page 113) in each issue. Usually more than half the listings run on all the micros. Software reviews always state which micros a product works on.



Compact: Programs available

***Acorn User* put two *Gallery* discs on 3.5-inch discs (at the *same price* as 5.25-inch) and, guess what? – there was no demand! Also the 5.25-inch discs and ROMs have been checked on the Compact.**

***Acorn User's* publisher, Redwood, runs on a network of some 40 Compacts, which is the best way to ease disc transfer between formats.**

Finally, *Acorn User* will put your 5.25-inch discs (DFS or ADFS format) onto 3.5-inch ADFS (or vice versa). Send your disc plus a £5 cheque to Disc Transfer, *Acorn User*, 20-26 Brunswick Place, London N1 6DJ.

COMPACT TRANSFER

Sir, I have just upgraded from an Electron (with Plus 1) to a Master Compact, and wish to transfer my tapes to ADFS discs as used by the Compact. However, the Compact has no cassette interface, so how can I do it?

C J Stump
London

I'm afraid there is no simple way to do this; try to borrow an Electron Plus 3 – which includes a 3.5-inch disc drive – and transfer your tape programs to that. These discs can then be used directly in your Compact. Another way is to use a network.

Note that there was a series on the Compact running from the November 1986 to May 1987 issues. The January 1987 issue covered installing the RS232 port and transferring files that way.

SOLIDISK SOCIETY

Sir, I wish to inform your readership of a user group for Solidisk products called Solinet. It is run by Ken Hardacre at 13 St John Street, Bridlington, East Yorkshire YO16 5NL.

This group is impressive in it's friendliness and helpfulness – a stark contrast to Solidisk, always economical with useful advice in my experience. The group also produces a bimonthly disc of help, letters, tips and programs.

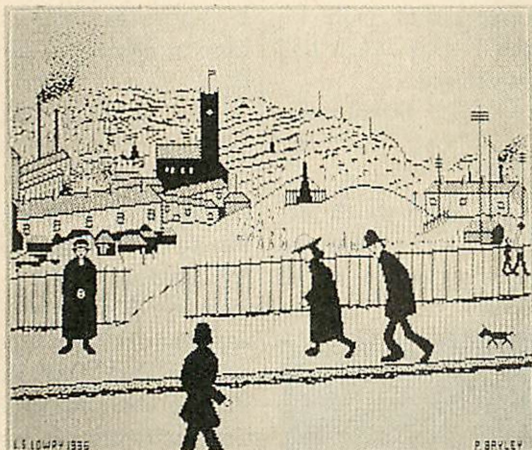
I can thoroughly recommend this group as a refreshing contrast to the often disillusioning attitude Solidisk has towards its customers!

Ewen Sim
Royal Medical Society
Edinburgh

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This unbeatable subscription offer is only available to UK subscribers, and we must receive your order before January 31st 1988, so hurry and make sure you post your subscription today!

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HINTS & TIPS

Martin Phillips takes a nostalgic journey through some early programming lessons and re-introduces some useful listings for beginners

This is the 50th Hints & Tips that I have presented in *Acorn User*. To celebrate this I have included five short programs to while away the long winter nights.

I remember the fascination with my first computer when I typed in a series of short programs and managed to understand and alter them. Today there are very few of this sort of program published. Most authors have gone on to bigger things.

A look at many of the current computing books confirms this. Most go through the main Basic commands with examples simply to illustrate the point, or they give elaborate programs with several pages of listing but very scant descriptions.

In these five programs I have tried to include a variety of techniques which go beyond the basic commands to show how some interesting and useful effects can easily be created. For each program there is a line-by-line description of how the program works.

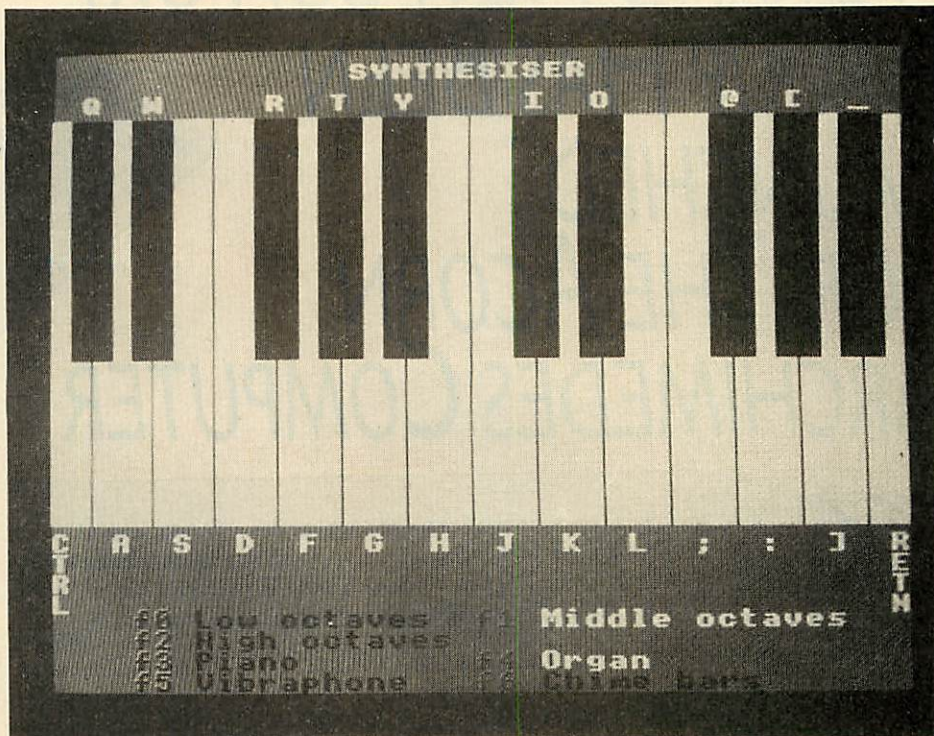
The programs will work on all machines, except the simple synthesiser, listing 1, where there is a separate version for the Electron (listing 2). Also, Electron owners will need to ignore a line in some of the programs; this is noted as appropriate in the program descriptions.

A SIMPLE BBC MICRO SYNTHESISER

This program, listing 1 in the yellow pages, turns the computer into a synthesiser, capable of playing up to three notes at once. For this reason it will not work on the Electron, as the Electron does not have the same sound system as the BBC micro. Therefore there is a special version of this program for Electron owners (listing 2).

It is interesting to observe that most of the program is taken up with programming the screen display and with testing the keyboard for responses, together with the subsequent decoding, and that the parts of the program that actually make sounds are quite short.

Although they are complex to understand, once a knowledge of the SOUND and ENVELOPE statements has been acquired their use is quite elegant. The range of the synthesiser (BBC version) covers four octaves. These can be changed by using the function keys.



The keyboard produced by listing 1

As there are physically only enough keys on the computer keyboard to cover two octaves, the synthesiser is set to use the middle two octaves. By using the function keys, the range can be changed so that the keyboard plays the lower or higher pitched octaves instead.

There are four voices programmed into the synthesiser: a piano, an organ, a vibraphone and chime bars. The sound produced bears a vague resemblance to these musical instruments.

Description of program

Lines 10-50 The normal *Acorn User* program heading. Leave these lines out if you wish, although it is often useful to know where the listing came from at a later date.
70 PROCinitialise sets up all the envelopes and then initialises any data required by the program.
80 PROCscreen draws the screen keyboard layout.
90 PROCprint displays the function key assignments on the screen and highlights the active keys.
100 PROCrun is the main procedure of the program.
130 Dimension arrays L%, M% and C%. L% stores the negative INKEY values for the keys needed, M% is a temporary array to check whether a key has been held down and C% is the sound channel number array.
140-170 Define the four envelopes.
180 The variable 'octave' determines which octave the keyboard plays in.
190 Switch off the cursor. This method of switching off the cursor will 'survive' the text cursor and the graphics cursor being joined using VDU 5.
210-280 Enter the negative INKEY values into array L% and put each element of array M% to 0. See the User Guides for a list of the negative INKEYs
320 Join the text and graphics cursors.
330 Change the background colour to blue.
340 Change the yellow to black.
350-370 Fill a rectangle in white. This uses a graphics window and clears the screen to white.
380-470 Draw in all the black notes on the white background. Uses the same technique for colouring rectangles. A data statement is used to give the horizontal

start point of each of the five black keys in an octave.
490-530 Draw black lines to divide the white keys.
540-610 Label each key. Note that the spaces in these lines are critical for correct screen layout, as are the semi-colons in lines 590-610.
640 Print title.
690-730 The main loop of the program. It scans through each key in turn and calls up PROCsound if a new keypress is detected.
760 Filter out the four function keys that change the envelope.
770 Filter out the three function keys that change the octave range.
780 This procedure stops the note playing if the key is no longer being pressed.
800-820 The variable J% selects the appropriate sound channel.
860 Sound the note defined.
1060 This procedure prints the function key descriptions on the screen, colouring the key number in red and the description of its function in black. The keys that are actually in use are highlighted by having their function printed in white. This routine is accessed every time a function key is pressed.

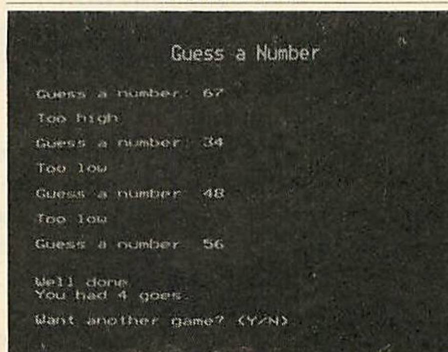
AN ELECTRON SYNTHESISER

Listing 2 is an Electron version of listing 1. The main differences are that only one note can be sounded at once and there is only one instrument, an electric organ. The pitch is changed by pressing the Shift key. On the screen is a display of a piano keyboard, with the Electron keyboard keys indicating the note. There is a short machine code routine to scan the keyboard and return the value of the key pressed. Using Basic for this is too slow and interferes with the sound produced.

Description of program

70 PROCinitialise sets up the envelope, and initialises the variables and the keyboard array.
80 PROCmachinecode is a short machine code routine to test if one of the selected keys has been pressed.
90 PROCscreen is the procedure to draw the piano keyboard screen display, which then remains static while the main loop of program is run.
100-120 The main loop of the program. It checks to see if a key has been pressed and sounds the appropriate note.
150 Envelope definition.
190 Switch cursor off.
200-250 Put the negative INKEY numbers into locations starting at &C80 so that the machine code keyboard scan routine can access them.
280-580 A two-pass assembler routine which will store the machine code at &C00. It scans the keys defined from locations &C80 onwards and returns the value in location &70. It uses Osbyte 129 (&81) which is equivalent to the Basic INKEY statement. The routine scans the negative INKEY numbers stored at locations &C80 onwards to check if it is one of the notes that has been pressed.
600-630 A routine to make the Electron pause for half a second.
660 Change background colour to blue.
670 Change colour 2 to black.
680-700 Define graphics window and clear screen to white.
710-800 Draw the black keys. The start and end co-ordinates are taken from the DATA statements.
810 Reset the graphics window to show the full screen area.
820-860 Draw in black lines in order to separate the keys.
870-920 Print legends on the screen. The spaces are critical in these two lines.
960 This is a check to see if the Shift key has been pressed. It reverses the action of the last Shift press.
970 Go to the keyboard scan routine.
980 Z% is the pitch parameter variation between the low octaves and the high octaves, selected by the Shift key
990 If a key has been pressed, then sound the note.

GUESS A NUMBER



A simple number-guessing game

Listing 3 is the well-known game of guess a number. It was frequently seen in the early days of the Acorn Atom. It is a good program to experiment with – all sorts of frills can be added to it. The computer chooses a number randomly in the range one to 100. You have to guess the number that the computer has chosen.

Description of program

Line 60 Set the print formatting to 0. This means that no spaces are printed before numbers. This avoids having to use semi-colons before numeric variables in order not to have unsightly spaces.
80 A procedure to set up the screen display for the game.
90 The main procedure of the program.
100-120 A loop to give the chance of another game.
170-190 Print a double-height title and create a text window. Electron owners should ignore line 180.
230 Randomise the random number generator. If this is not done, each time the computer is switched on and this program loaded, exactly the same sequence of random numbers will be given. The internal clock is used to 'seed' the random number generator to avoid this.
240 Select a random number in the range 1 to 100. Store it in the variable 'number'.
250 The variable 'count' is used to store the number of tries taken.
260-310 Get a number and then check it against the chosen number. If it is not correct then jump to the appropriate procedure. This loop will repeat until the correct number is guessed.
320-330 Print a message and the number of tries taken.
360 A 'skeleton' procedure to indicate a low guess. A low sound is also produced. A refinement that could be made here is to link the pitch to the difference between the guess and the correct number.
410 A 'skeleton' procedure to indicate a high guess.

HEX TO DENARY CONVERTER

Listing 4 in the yellow pages is a short program to convert values from hexadecimal to denary or from denary to hexadecimal. If the number entered is preceded by the '&' sign to denote a hexadecimal number, then it is converted to denary,



Hexadecimal to denary converter

otherwise it is converted to hexadecimal. Thus there is no need to have to go to separate parts of the program, or to have to tell the program each time you enter a number which conversion to make – which can become very tedious.

This program also uses the micro's messages to detect when errors in number entries are made – numbers which are too big or non-hexadecimal characters. The program could be improved by the use of colours, say using different colours for hexadecimal or denary numbers. A printout can be obtained at any time by simply pressing CTRL-B and then Return when asked for a number. Similarly to abandon the printout simply press CTRL-C and then press Return.

Description of program

Line 60 Use mode 7 for simplicity.
70-80 Print the title in double height. Electron owners should either delete line 80, or use the double-height routine given in listing 5, and then change line 60 to MODE 4.
90 Set a text window so that the screen can scroll without wiping the title.
110-170 An infinite loop forming the main part of the program.
120-140 A routine to input a number. The routine checks to see that something has been entered.
150 Print an equals sign with a space at either side.
160 Check to see whether the number is hexadecimal. If so then go to the 'hex' routine to be converted, else go to the 'den' procedure to be converted.
210-230 The procedure to convert hexadecimal to denary. The EVAL function is used to do this.
250-270 The procedure to convert denary to hexadecimal. This looks complicated, but there is no simpler way.

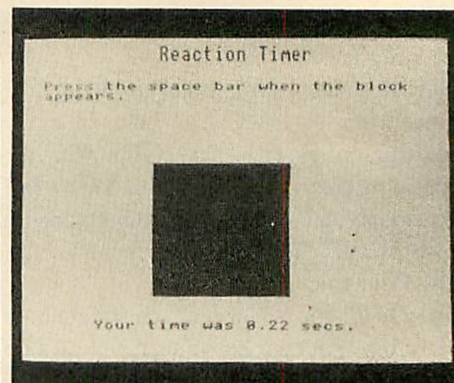
REACTION TIMER

This program, listing 5, tests your reaction time by displaying a red block on the screen and measuring the time before the space bar is pressed. The block appears with a random delay of between two and 12 seconds.

After the reaction time has been given, pressing the space bar again will clear the screen ready for another go. The program works in mode 1; the screen has a white background, with the title appearing in blue in double height.

Description of program

Lines 10-50 The normal *Acorn User* program heading. As usual, you can leave these lines out if you wish, although it is often useful to know where the listing came from at a later date.
60 DIM a block of memory nine bytes long. A value of eight is used as the computer starts counting at zero. This is needed for the double-height routine.
70 Set the screen to mode 1 to enable graphics and four colours to be used.
120 The procedure to set up the screen display for the program.
130 Set the background colour to white.
140 Change the normal drawing colour from white to blue.
150 Print the title in double height.
160-170 Print instructions. There are two spaces after the first set of speech marks to centre the text on the screen.
180 Define a text window so that the title and instructions are kept on the screen when the screen is cleared.
190 Switch off the cursor.
220 The main procedure of the program.
230 Change the graphics background colour to red. This forms part of the routine to produce a red square on the screen.
240-350 The main repeat loop of the program that will do the reaction time test. This is an infinite loop, because '0' in line 350 is always false.
250 Set the internal Basic timer to zero.
260 Set a random delay before the block is shown. The internal clock works in centiseconds (100ths of a second). There is a minimum delay of two seconds, and a further random delay of up to 10 seconds.
270 Define a graphics window.
280 Clear the graphics screen. As the background graphics colour has already



A reaction timer program

been changed to red, the graphics window will clear to a red background, thereby giving a red square on the screen. This is the fastest and easiest way of producing a coloured block on the screen.
290 Clear the keyboard buffer.
300 Reset the internal timer to zero.
310 Wait for the space bar to be pressed.
320 Print out the elapsed time.
330 Wait until the space bar is pressed again before continuing. The use of the same key prevents cheating because holding down the space bar, or tapping rapidly, not only produces an amazing reaction time but also clears the message so quickly that the time cannot be read!
340 Clear the screen.
380 The procedure to print the title on the screen in double height.
390 This procedure uses an Osword call with A% set to 10. This obtains the character definition of a given character. It is given in the same form as that used for the user-defined characters. X% and Y% point to a parameter block (dimensioned at line 60). The first byte will hold the ASCII number of the character for which the definition is required. When the routine is called, the definition is returned in the next eight bytes of this parameter block.
420 When the definition has been obtained, each of the eight lines of the definition is printed twice. C$ is a string to print the first of the two newly defined characters, then move the cursor down a line and back a space before printing the second newly defined character.
430-500 A loop to get each character of the string in turn and print it.
440 Pick out one character from the string and put its ASCII value into the parameter block. Then the Osword call is made.
470-480 Program the two new characters.
490 Print the double-height character in the appropriate place.

CODE BREAKER

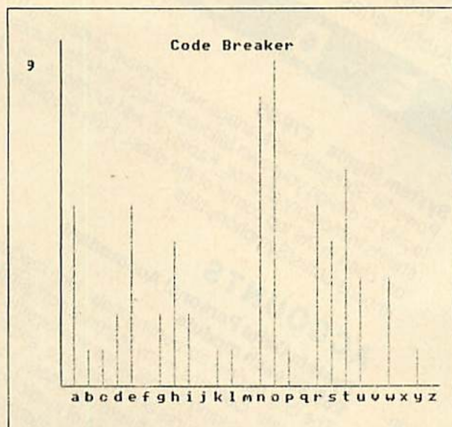
Listing 6 (right) is a graph drawing program. It's called a code breaker because the program looks at the frequency of letters in a piece of text, a common technique in breaking secret codes.

The program will ignore the case of each letter when graphing. Mistakes can be corrected using the delete key as normal. Once all the text has been entered, the graph is drawn by pressing the asterisk.

The graph is auto-scaling – that is, it looks for the largest column and then adjusts the graph accordingly so that this column is the full height of the graph. Once the graph has been printed, pressing the space bar will finish the program.

Description of program

Line 60 Dimension a store for the text. This has been set to 1000 characters. Also an array is dimensioned to hold the count for each letter.
70 Use mode 7 for entering the text.
80-120 The four main parts of the program. PROCscreen sets up the screen display for text entry. PROCinput inputs the sample text. PROCcollate goes through the text counting the occurrence of each letter. It then checks to find the greatest single count. This is needed for the auto-scaling part of the program. Finally, PROCgraph draws the graph.
130 Wait until the space bar is pressed.
180-190 Print the title in double height. Electron owners should either delete line 190, or use the double-height routine given in listing 1, then change line 70 to mode 4.
220 Define a text window, so that the screen can scroll without losing either the title or the instructions.
250 Inputs the text and stores it.
260 S% is used as the character counter.It not only indicates how long the text is, but also can be used to point to the next free point in the memory store.
270-330 A loop to input the text. It is terminated when either the memory limit is reached or an asterisk is pressed.
280 Get a character from the keyboard.
290 Print the character on the screen. This line is necessary because the GET statement does not 'echo' the keypress on the screen. The semi-colon prevents each character being printed on a new line.
300 If the key pressed is not the Delete key then store the character, and increment the counter by one.
310 If the key pressed is the Delete key then reduce the counter.
320 If the key pressed is the Return key, then move down one line.
330 Test for the store being full or the asterisk being pressed.
340 Give a beep.
380-420 A loop goes through the whole text, which is now stored in memory, a character at a time, to count the frequency of each letter.
390 The capital letters of the alphabet have ASCII codes of 65 onwards. For simplicity, in the rest of this routine it is easier to work with 'A' having a value of 1, hence 64 is subtracted from each ASCII value.
400 Check for a lower case letter, and if so reduce its value by 32 so that a lower case 'a' now has the same value as a capital 'A'.
410 If the character is a letter, then increment the appropriate letter count by one.
430-460 Check through each letter count to find the highest value. This is stored in the variable 'count', and will be needed for the auto-scaling part of the program.
490 The procedure to draw the graph.
510-520 Draw the two axes of the graph.
530 Join the text and graphics cursors. This is needed to be able to label the horizontal axis with the 26 letters of the alphabet in that they fill the whole of the axis.
540 Move the graphics origin.
550 Make the background colour to green.
560 Change the normal drawing colour (colour 3) to black.
570 Change colour 2 to blue.
580-610 Label the horizontal axis.
620 Work out the scale.
630-640 Label the vertical axis with the maximum count value.
650 Change the drawing colour to blue.
660-690 Draw each bar of the graph.



The codebreaker graph

```
   10 REM Hints & Tips L
isting 6
   20 REM By Martin Phil
lips
   30 REM for B/B+/M/C/E
   40 REM (c) Acorn User
 December 1987
   50 :
   60 DIM store 1000,let
ter(26)
   70 MODE 7
   80 PROCscreen
   90 PROCinput
  100 PROCcollate
  110 MODE 1
  120 PROCgraph
  130 REPEAT UNTIL GET=3
2
  140 MODE 7
  150 END
  160 :
  170 DEF PROCscreen
  180 PRINT TAB(12,1)CHR
$141"Code Breaker"
  190 PRINT TAB(12,2)CHR
$141"Code breaker"
  200 PRINT '"Press * to
 finish"
  210 PRINT '"Enter text
: "
  220 VDU 28,0,24,39,6
  230 ENDPROC
  240 :
  250 DEF PROCinput
  260 S%=0
  270 REPEAT
  280 g=GET
  290 PRINT CHR$(g);
  300 IF g<127 THEN S%?s
tore=g:S%=S%+1
  310 IF g=127 THEN S%=S
%-1
  320 IF g=13 THEN VDU 1
0
  330 UNTIL CHR$(g)="*"
OR S%=1000
  340 VDU 7
  350 ENDPROC
  360 :
  370 DEF PROCcollate
  380 FOR N%=1 TO S%
  390 char=(N%?store)-64
  400 IF char>32 AND cha
r<59 THEN char=char-32
  410 IF char>0 AND char
<27 THEN letter(char)=le
tter(char)+1
  420 NEXT N%
  430 count=0
  440 FOR N%=1 TO 26
  450 IF count<letter(N%
) THEN count=letter(N%)
  460 NEXT N%
  470 ENDPROC
  480 :
  490 DEF PROCgraph
  500 PRINT TAB(14,0)"Co
de Breaker"
  510 MOVE 112,64:DRAW 1
280,64
  520 MOVE 112,64:DRAW 1
12,1024
  530 VDU 5
  540 VDU 29,96;64;
  550 VDU 19,0,2;0;
  560 VDU 19,3,0;0;
  570 VDU 19,2,4;0;
  580 FOR N%=1 TO 26
  590 MOVE 44*N%,-16
  600 PRINT CHR$(96+N%)
  610 NEXT N%
  620 scale=INT(900/coun
t)
  630 MOVE -90,count*sca
le
  640 PRINT;count
  650 GCOL 0,2
  660 FOR N%=1 TO 26
  670 MOVE N%*44+12,0
  680 DRAW N%*44+12,lett
er(N%)*scale
  690 NEXT N%
  700 ENDPROC
```

Listing 6. Code breaker

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FIRST BYTE

SIMPLE FILES

Any serious machine code programmer needs to be able to use filing systems. It could be easier than you think

Tessie Revivis

Over the past 12 months or so we have been looking at assembly language programming on the BBC, Master and Electron. Of course, we've really only just begun to scratch the surface, but if you have been following the articles you will have a sound knowledge of the basics.

We're not going to forget about machine code; instead we're going to turn our attention to specific areas which are of interest to all programmers, and apply the assembly language techniques we have learnt so far.

The sort of adverts and articles that are appearing in the pages of magazines are no longer restricted to games or character definers and the like. More important now are applications – programs with practical uses that you use to make life more manageable. To write virtually any application program, you will need to be capable of file handling, so the application can store its data. So the topic we'll be covering in the next couple of months is file handling.

Before going on to use files, we need to define exactly what a file is. For the purposes of this article we will assume that DFS is being used, although all the techniques used apply equally well to ADFS and NFS. If tape is being used, the operations that can be performed on a file are far more restricted, but the assembly language techniques are the same.

A file is a sequence of bytes on a disc. From the filing system's point of view these bytes are meaningless. It is up to the program using the file to interpret them. For example the bytes could be a word-processed text file or a list of names and addresses or a Basic program. The filing system can't tell the difference!

Each disc contains a list of all the files saved on it. This is called the catalogue. In addition to a file's name, the catalogue also contains other information about the file. The most important item stored is where on the disc to find the sequence of bytes that make up the file. This is seldom of any interest to a programmer. The other information held in the catalogue is:

- Load address. This address specifies where the file will be loaded into memory if *LOAD is used.
- Execution address. For a machine code program file, this is where the program starts from.
- Length. The size of the file in bytes.
- Attributes. Special information bytes – they show, for example, whether a file is 'locked'.

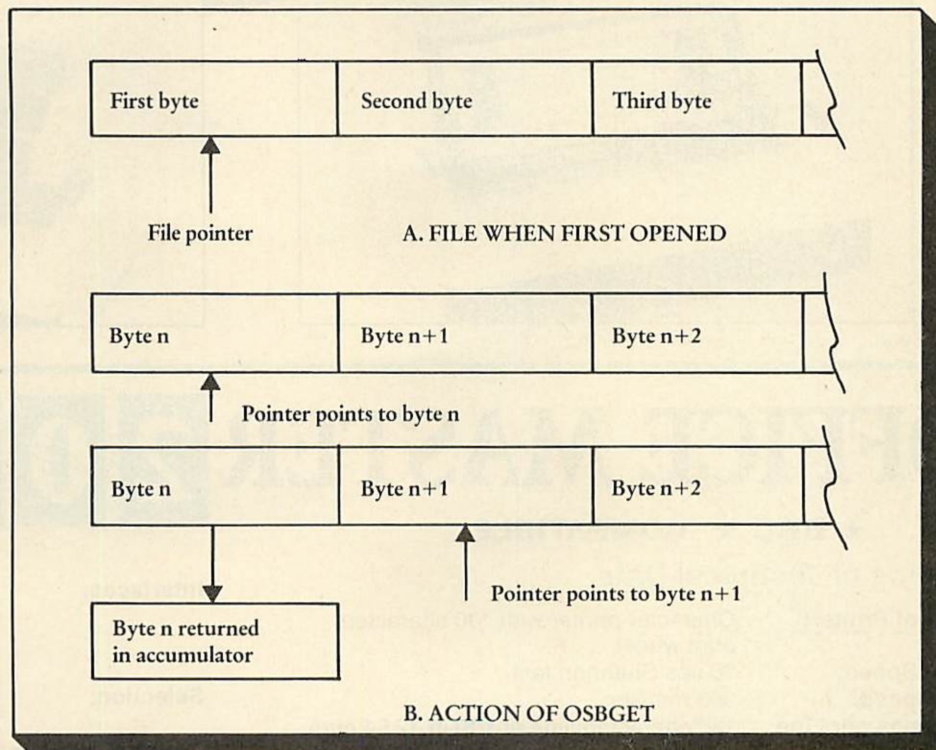


Figure 1. Pointers indicate the start of the file

Accessing the contents of a file is possible in one of two ways: either all in one go or one byte at a time. Let's look at the byte by byte method first.

To use a file on a byte by byte basis, it is necessary to perform an operation known as 'opening the file'. When a file is opened, the filing system reads the file's catalogue information from the disc and stores it for future reference. When it does this, it creates what is called a 'channel' through which the program can access the file. The channel it uses is identified by a number called a 'handle'.

The handle number needs to be stored in a variable by the program. The handle in the number you put after Basic keywords like BPUT# and PRINT#. More than one channel can be opened, and each will have a different handle, so you must always use the right handle number for the appropriate file. The DFS allows up to five channels to be open at once.

When a file is opened, using the equivalent of OPENIN or OPENOUT the filing system also creates a pointer that initially indicates the first byte in the file, as shown in figure 1A. The pointer is a number and

increases by one each time you read a byte from the file. This process is shown in figure 1B; as the byte is read, the pointer advances so it always points to the next byte to be read.

Writing to a file a byte at a time works in a similar way, except that the pointer now points to the next byte to be written. It is also possible to create a channel which can be read and written to simultaneously, using OPENUP for example. But this is a more advanced idea than we normally deal with here.

Having described how byte-accessed files work, we will now look at how to use them from assembly language. To make life easy and to allow programs to work with any filing system, all operations are done through a set of standard 'entry points' in the operating system. These routines work in a similar way to other OS routines such as Osbyte and Osword. There are five entry points which are relevant to byte access files. These are:

- Osfind – for opening/closing file channel
- Osargs – to read the file length and the pointer for a channel
- Osbput – write a byte to a file
- Osbget – read a byte from a file
- Osgbpb – transfer a whole lot of bytes to or from a file in one go

Let's look at each of these calls in turn. Osfind opens or closes a file. When opening, it causes the filing system to allocate a channel number to the file so that it can be accessed. When closing a file, it de-allocates the channel number and tidies up the catalogue information. The call is issued from machine code using JSR &FFCE, and the value in the accumulator determines what operation is performed. Possible accumulator values are:

- &00 – Close a file channel.
- &40 – Open a file for reading from
- &80 – Open a file for writing to
- &C0 – Open a file for both reading from and writing to

The Osfile call needs to know which file on the disc is to be opened, so the name must be supplied in a parameter block. If a file is being opened, then the filename should be stored in memory somewhere, with a carriage return character (&0D) at the end. The X and Y registers should point to this name with the low byte of the address in X and the high byte in Y in the usual way.

After the call, the accumulator contains the channel number allocated by the filing system. If this value is zero it means that the file couldn't be opened, most likely because the file name was not found in the catalogue. Watch out though, because the Z flag need not be set even though A contains zero. So a simple BEQ instruction won't necessarily be enough to trap this error. You should use something like CMP #0 before testing the Z flag with BEQ.

When a file is closed, the routine is called with zero in the accumulator and the handle of the file to be closed in Y. A special case is when Y=0, which closes all open files. As an example the code below might be part of a program that used a file called 'DATA' on the disc:

```
LDA #&40
LDX #name MOD &100
LDY #name DIV &100
JSR &FFCE
CMP #0
BEQ error
STA handle
RTS
.name
EQUS "DATA"
EQUB 13
EQUB 0
```

This code opens the file. When we've finished with it, the file must then be closed like this:

```
LDA #0
LDY handle
JSR &FFCE
RTS
```

It is vital that all the open files are closed when you have finished with them. The filing system can only keep a few files open at once. For example, the Disc Filing System can maintain only five open files, and the limit with the Advanced Disc Filing System is 10. So if you keep opening files and not closing them, then you will eventually exceed this limit and get a 'Too many open' error. Even pressing Break doesn't necessarily close the files.

JARGON BOX

Filing system: The built-in program which stores data on disc or cassette and retrieves and manipulates it.
Catalogue: Information on the disc telling the computer where the files are, how long they are, where in memory to load them and so on.
DFS: Disc Filing System, the standard Acorn filing system.
ADFS: Advanced Disc Filing System, a more sophisticated version used in the Master series and the Archimedes.
NFS: Network Filing System, the version for micros linked together and to a file server by Econet.
Call: Using a routine that is part of the built-in operating system from a program of your own.

The code is the box closes the file whose file handle is loaded into the Y register. It is also possible to close all the open files at once, by loading Y with zero before calling Osfind. This is the equivalent of the Basic command CLOSE# 0. One major problem with this is that some versions of the Master 128 DFS have a bug associated with Osfind, which makes files the wrong length if they are closed in this way. To find out if your machine has the problem DFS, try the following:

```
F%=OPENOUT "TEST"
CLOSE# 0
```

Now type *INFO TEST. The third number displayed is the file length, and if this is not zero, then your DFS has the bug. It is possible to get a newer version of the DFS from Acorn that loads into sideways RAM and overcomes the bug.

Reading and writing to a file is achieved with the following calls. Osbget reads a byte from the channel in Y and puts it in the accumulator. It is called using JSR &FFD7. Osbput which is called as JSR &FFD4, writes the byte in the accumulator to the file whose handle is in Y.

A successful Osbget is signalled by the carry flag being cleared (C=0) when the routine returns. However, it is not possible to read past the end of a file as there is nothing to read. If you try, Osbget returns with the carry flag set (C=1). If this occurs, the contents of the accumulator should be ignored, and usually the file should be closed.

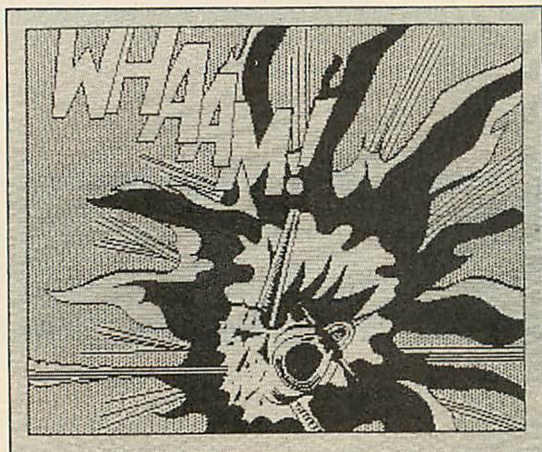
Listing 1 on the yellow pages illustrates accessing a file a byte at a time using these calls. It is a variation on the *DUMP command found in the DFS and in the Master operating system. After entering the listing, run it. If all is well, it will be assembled in the cassette buffer memory starting at location &900, then saved to disc as a program called 'DUMP'.

To use the program ensure that the OSDUMP file is on the disc and then enter *OSDUMP. You will be asked to enter a filename, then the file contents are printed out in hex and as ASCII characters.

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ACORN FORUM

This month readers have sent David Atherton advice on broken directories, quality printing and slow motion, to name but a few

£20

BROKEN DIRECTORY CURE

Here's a life saver of a program from Stephen Oxley of Benfleet, for when you get the dreaded ADFS error 'Broken directory'. The cycle number and identifier string ('Hugo') are stored twice in a directory, and it's usually these that go. As long as the two cycle numbers are the same, and the identifiers are there, the directory will catalogue properly again, and most or all of the files can be salvaged. If an individual file reference is dodgy, then you may still have problems, but this program can make the difference between losing a couple of files, and losing the whole disc.

Run listing 1 in the yellow pages, which saves a machine code program called FIX. Makes sure it puts FIX in the root directory, or perhaps the library directory. The machine code is assembled to run at &E00 for a Master 128, but can be assembled elsewhere, for a model B or B+ or a Master on which PAGE is not &E00, by altering the variable 'start$'.

If you lose a directory other than the root or directory where FIX itself is, you can run it by typing *FIX followed by the full directory path excluding '$', ie, *FIX LETTERS.NOV. If you've lost the root directory, you should *LOAD the program into memory from another disc, then *MOUNT the disc with the broken directory and call the address three bytes in from the start, for example CALL &E03. If you aren't in Basic then use *GO E03.

The program works by reading in sectors 2-6 (the root directory) from the disc and using this to work down the path, loading in further directories as it goes, until it finds the required directory. When that is loaded, it uses Osword &72 to read sectors directly; the sequence numbers, identifier string and directory title and name are checked for consistency, altered if necessary, and the sectors are then resaved to the disc.

The program will only fix directories broken by an inconsistency, and can't handle a disc corrupted magnetically, so the ADFS disc must still verify correctly for the program to work.

£10

NLQ AND ITALICS IN VIEW

```
Stuart   has   solved   this by
writing his own View printer
driver   which   puts the LX80
into     NLQ     mode    before
beginning printing, and then
switches  underlining on  and
off with  highlight  1,   and
italics   on   and   off  with
highlight  2.    The  italics
are printed  in non-NLQ mode.
This   is   an  example  of what
it can do.   It   works   with
most  other Epson compatible
printers  too.    The  printer
must    be    set    up    with
automatic line feed; this is
normally   done   using    an
internal DIP switch.
```

Text printed with Stuart's routine

In his Business column in *Acorn User*, September 87, Graham Bell looked at the problems of italicising text with *View* family printer drivers. Stuart Rogers of Preston has an Epson LX80 and wanted to include italics in his NLQ output from *View*. But this printer, like many others, doesn't contain an italic version of the NLQ font, so the printer must revert to normal type first.

Stuart has solved this by writing his own *View* printer driver which puts the LX80 automatically into NLQ mode before printing, and then switches underlining on and off with highlight 1, and italics on and off with hightlight 2. In fact, highlight 2 switches off NLQ, switches on normal italics, and emphasised type. The next highlight 2 switches off emphasised type and italics and restores NLQ. The default USA font is used so # gets printed as #. The £ character is selected from the UK font automatically; the tilde character (~) is used as 'exact space'. In both cases, the characters used may be altered before assembly by substituting the correct codes in the listing. The driver has been carefully written to enable the user to easily edit these features.

Run the assembler source listing (yellow pages listing 2) and the file NLQ+IT will be created. The driver is loaded by typing PRINTER NLQ+IT from within *View*, *ViewSheet* or *ViewStore*.

If necessary, alter the sequences which began at 'setup' to contain the correct codes for your printer. In particular, the Kaga/Taxan and Canon printers select NLQ differently. Lables like 'ulon' and 'ital' make it obvious which codes are for what effect. Your code sequence can be of a different length, but must end with a -1, which is used as a terminator, not a print code. The listing is also a useful example of how to write a printer driver.

£5

PRESERVATION OF VARIABLES

Regular contributor Jonathan Temple has been writing large assembly language programs, and like everyone in that position, has found that the memory of his BBC micro is not up to it. There are many ways, some very technical, some rather obscure, to do multi-file assembly, but I think one of the neatest has got to be this one, which preserves the values of the all the variables to a file, which is then reloaded when the second program is installed. To see the effect in operation, run the first listing, listing 3, which creates a file on disc called VARS, and then run the second, listing 4, which reloads it and recovers the variables.

There are two limitations to the program – procedure names in one program must not be duplicated in the other, and LOMEM must be set to the same value at the start of each program. An example setting of LOMEM for Electron users is given in the listing. BBC owners can use mode 7 and set LOMEM to &7000. When reading the variables back in, all old variables are overwritten, so the recovery method in the second listing should be at the start of the main program, and not in a separate procedure.

How do the routines work? Well, BBC Basic stores variables and procedure names from LOMEM, or just above TOP for the current program. A two-byte 'free space' pointer at &0002 contains the address of the next free byte in memory, that is the address after the end of the last variable currently stored. The save routine uses LOMEM and this pointer to save the variables area.

At the same time, the variable map is saved. This extends from &482 to &4FF and contains pointers to the position of variables within the storage area. So that it can be saved together with the area in just one file, the map is copied to the memory just above the variable area. Reloading the variables consists of loading the file, then copying the map back to page &04.

£10

MASTER SLOW-MOTION ROM

Martin Hesketh of Ryton, Tyne and Wear, had submitted a neat program to slow down the execution of virtually all programs, including most commercial games on the Master 128. Run the assembler source listing, listing 5 in the yellow pages, and then press CTRL-Break. To test that the program is working, tap the '*' key on the numeric keypad. If everything has worked correctly, the cassette relay will click.

Once installed, the following numeric keypad keys control the speed of the computer: '*' and '#' switch the slow motion on and off respectively, and '–' and '+' control the speed of execution. To increase the speed of the program keep tapping the + key. Continually pressing the – key will slow the program more and more. Switching the slow motion on and off also clicks the cassette relay as an indication that it is working.

The program will continue to work after a soft reset, a hard reset, or a reset when the memory has been cleared (using *FX200,2). However, after any type of reset the slow motion will be switched off.

It works by using the Master ROM polling feature, where the operating system issues a service call to sideways ROMs every 10 milliseconds. The code picks this up, and pauses for a short time before returning. This means that, unlike many such programs, the interrupt vectors are unaffected, which is good, because many games where you would wish to use this feature use the interrupt vectors.

The program as it stands works only on a Master and Compact (except the cassette relay feature, of course). Interestingly though, the Electron also supports ROM polling, and the program could be converted to run on an Electron with sideways RAM quite easily. You would have to alter the key numbers, and convert the 65C02 opcodes back to 6502 equivalents.

£5

EXTENSIONS TO ADFS 'FIND'

C P Armstong from Wolverhampton has been using David Spencer's FIND utility from September's Forum, but says that when he forgets a file on his ADFS disc, he often forgets the precise name. He has therefore added a wildcard facility to the program. With this you can use a '*' in the name of the string to signify any number of characters (just like DFS). A single star will list every file on the disc, and so provides a 'CATALL' facility, like the program on the Master's Welcome disc. Mr Armstrong has found a problem with the variable 'fnd' being set to zero page location &AF, and has reassigned it to &90, in the Econet work space.

The modifications to the program are given as an additional listing. To use them, you should load in your original copy of FIND, which must not have been renumbered from the listing printed in September. Type in these new lines, which will overwrite some existing lines in the program. Even the lines containing just colons must be typed, as these have the effect of deleting the original lines. Then you can, if you wish, renumber the program, and re-run it. A new, slightly longer machine code file will result, which will accept the star as a wildcard.

Mr Armstrong also points out that it would be a good idea to run the program in sideways RAM or, for Master users, in the 12k of work space at &C000. I'll leave the organisation of that up to you!

That's all from Forum this month. See you all in 1988 – we'll be featuring lots more of your favourite material including plenty for the Archimedes, but we won't forget the trusty model B and Electron. A quick tip for all you new Archimedes owners from Chris Snee: if you decide to reset the CMOS RAM by pressing R during power-up, you will find that the monitor goes blank, as the system is defaulting to a multi-sync display. Don't worry; simply repeat the procedure, and the system will return itself to a standard monitor output.

Send your ideas to Acorn User, *20-26 Brunswick Place, London N1 6DJ.*

```
 100 fnd=&90
1690 LDA #13
1700 LDY #10
1710 STA (namptr),Y
1720 LDY #0
1730 LDX #0
1740 JSR test
1750 BNE find4
1760 :
1770 :
1780 :
1790 :
3820 EQUS " "
3821 EQUS "at &000000"
3822 EQUB 0
3823 .test
3824 LDA #13
3825 CMP (namptr),Y
3826 BNE ln20
3827 LDA lbuff,X
3828 CMP #ASC "*"
3829 BNE ln10c
3830 INX
3831 JMP test
3832 .ln10c
3833 LDA #&D
3834 EOR lbuff,X
3835 RTS
3836 .ln20
3837 CMP lbuff,X
3838 BNE ln30
3839 LDA #&FF
3840 RTS
3841 .ln30
3842 LDA (namptr),Y
3843 EOR lbuff,X
3844 AND #&5F
3845 BNE ln40
3846 INX
3847 INY
3848 JMP test
3849 .ln40
3850 LDA lbuff,X
3851 CMP #ASC "*"
3852 BEQ ln50
3853 LDA #&FF
3854 RTS
3855 .ln50
3856 TXA
3857 PHA
3858 TYA
3859 PHA
3860 INX
3861 JSR test
3862 BEQ eqrts
3863 PLA
3864 TAY
3865 PLA
3866 TAX
3867 PHA
3868 PHA
3869 INY
3870 JSR test
3871 BEQ neqrts
3872 .eqrts
3873 PLA
3874 PLA
3875 LDA #0
3876 RTS
3877 .neqrts
3878 PLA
3879 PLA
3880 LDA #&FF
3881 RTS
3882 ] NEXT
3883 ENDPROC
```

C P Armstrong's ADFS FIND program

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ARCHIMEDES

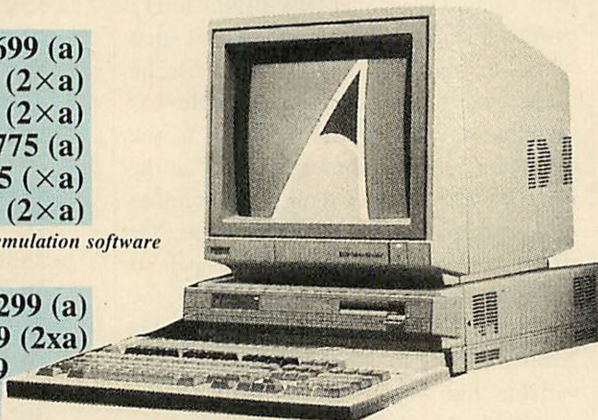
300 SERIES

Archimedes 305 Basic	£699 (a)
Archimedes 305 Mono	£749 (2×a)
Archimedes 305 Colour	£899 (2×a)
Archimedes 310 Basic	£775 (a)
Archimedes 310 Mono	£825 (×a)
Archimedes 310 Colour	£975 (2×a)

Add £6 to 310 range for inclusion of PC emulation software

400 SERIES

Archimedes 440 Basic	£2299 (a)
Archimedes 440 Mono	£2349 (2xa)
Archimedes 440 Colour	£2499 (2xa)



ADD-ONS

0.5Mb Ram upgrade kit for 305	£79 (c)
2nd Floppy Drive	£125 (b)
Podule Backplane	£39 (c)
20 Mb Hard Disc + Podule	£499 (a)

(Please enquire about the availability of some of the above packages)

SOFTWARE

ANSI C	£99 (c)
ISO Pascal	£99 (c)
Fortran 77	£99 (c)
Logistix	£99 (c)
View Professional	£99 (c)
Archimedes Ref Manual	£19.95 (b)
ARM Ass Lang Prog	£12.95 (d)

BBC MASTER COMPACT

All Compact Systems include a FREE educational/fun software bundle made up from BBC Publications software range.

SYSTEM 1 128K, Single 640K Drive & bundled software.	£319 (a)
SYSTEM 2 System 1 with a 12″ Hi Res Monochrome Monitor.	£369 (a)
SYSTEM 3 System 1 with a 14″ Med Res RGB Monitor.	£499 (a)
Second Drive Kit.	£95 (c)
Serial Kit.	£25 (c)
T.V. Modulator	£26 (d)
Extension cable for external 5.25″ 80T Drive	£12.50 (d)
Mertec Adaptor (Upgrades to almost master level)	£35 (c)

FILE STORE

Acorn's new file server system

Filestore E01	£828 (a)
Filestore E20	£710 (a)
Full details on request	
Acorn 30Mb Winchester (incl FS III Software)	£1530 (a)

ECONET ACCESSORIES

Econet Starter Kit	£85 (b)	Econet Bridge	£174 (b)
Econet Socket Set	£29 (c)	Printer Server Rom	£41 (d)
File Server Level II	£75 (b)	10 Station Lead Set	£26 (d)
Master FS Utility Disc	£17.25 (d)		

UPGRADE KITS

1.2 OS ROM	£15 (d)	ADFS ROM	£26 (d)
DNFS ROM	£19 (d)	1770 DFS Kit	£43.50 (d)
BASIC II ROM	£22.50 (d)	Econet Kit	£55 (d)

SECOND PROCESSORS

Universal 2nd Processor Adaptor	£75 (b)
Acorn 65C02 Turbo	£99 (b)
ACORN 512 PROCESSOR	£189 (a)
MULTIFORM Z80 TECHNOMATICs multi format Z80 system includes a FREE Pocket Wordstar + MS/DOS Read/Write Utility	£249 (b)

ACW/CO-PROCESSOR

32016 Co-processor	£949 (a)
Cambridge Workstation	£3450 (a)
X25 Gateway	£2175 (b)
10 MHz upgrade for Co-Proc	£255 (a)

ACORN IEEE INTERFACE

Allows BBC computer to control any scientific and technical equipment that conforms to the IEEE488 standard. The interface can link upto 14 compatible devices. Typical applications are in experimental work in academic and industrial labs. **£265 (a)**

EPROMS/RAMS

2764-25	£2.80 (d)
27128-25	£3.60 (d)
6264LP-15	£2.60 (d)
27256	£5.00 (d)
27512	£9.90 (d)

RAM/ROM EXPANSION

ATPL Board for Model B. Simple to instal, no soldering. Allows expansion to 15 Roms + 2*8K RAMS	£37 (c)
ATPL Battery backup kit	£18 (d)
ATPL Board for BBC+	£31 (c)

BBC MASTER SERIES

AMB15 MASTER **£346 (a)**

Master AMB15 includes a free educational/fun software bundle made up from BBC Publications software range.

AMCO6 Turbo 65C02 Module	£99 (b)		
ADC08 512 Processor	£189 (b)		
ADF14 ROM Cartridge	£13(d)	ADJ22 Ref Manual I	£14(c)
ADF10 Econet Module	£41(c)	ADJ24 Adv Ref Manual	£19.50(c)
ADJ23 Ref Manual II	£14(c)	View User Guide	£8.50(d)
BBC Master Dust Cover	£4.75(d)	Viewsheet User Guide	£8.50(d)

MASTER ROM/RAM CARTRIDGES

TRC1 Two rom cartridge	£8.95 (d)
TRC4 Four rom cartridge	£11.95 (d)
TRC 32K Cartridge inc RAM	£29.95 (d)

LEARN ARABIC WITH YOUR COMPUTER

مساعد تعليم العربيه

Convert your BBC or Master computer to bilingual operation with the BABEL Arabic Package.

Beautiful Arabic text. Software developed and tested in the classroom for 2 years to help the young read and understand Arabic.

The package comprises: an easy to install EPROM, a set of keycap labels, an instruction booklet and a disc with absorbing programs: Mastering the Arabic alphabet, Arabic grammar exercisess, English to Arabic and Arabic to English translation exercises.

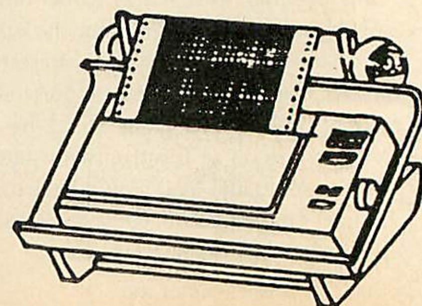
The BABEL Arabic Package	£70 (d)
Other Arabic educational software for the converted micro; each disc	£15 (d)

(Please specify 40 or 80 tracks). Send for more details.

Master Operating System (book by David Atherton) £12.95 (c)

PRINTER STAND

A new style printer stand with easy paper feed and paper seperation, provides complete access to paper. Can be used with both top and bottom paper feed. Very space efficient. **£26 (b)**



TECHNOMATIC

BBC COMPUTERS & ECONET CENTRE

17 Burnley Road, London NW10 1ED Tel: 01-208 1177

305 Edgware Road, London W2 Tel: 01-723 0233

PRINTERS

EPSON LX800 £180 (a)

EPSON FX800
An enhanced version of FX85. Call for details. £299 (a)

EPSON FX1000
An enhanced version of FX105. Call for details. £405 (a)

EPSON EX800 £409 (a)

EPSON EX1000 £549 (a)

Colour option for EX800/EX1000. £59 (b)

EPSON LQ800 £399 (a)

EPSON LQ1000
As LQ800 but wider carriage for 136 columns. £529 (a)

TAXAN KP815
Enhanced KP810 with 160cps and full IBM compatibility. £269 (a)

TAXAN KP915
Enhanced KP910 with 180cps and full IBM compatibility. £369 (a)

National Panasonic KXP1081
Now supplied with a BBC printer lead and our WYSIWYG Rom. This rom provides one of the most powerful and versatile printer drivers for WP and BASIC. (see description elsewhere in the directory) £149 (a)

STAR NL 10 (Parallel Interface) £190 (a)

STAR NL 10 (Serial Interface) £219 (a)

INTEGREX Multicolour Inkjet printer.
Ideally suited for high res colour VDU screen dumps. Quiteness & consistent output are major characteristics. £549 (a)
BBC Screen dump for Integrex. £15 (d)

BROTHER HR20
8K buffer standard expandable to 16K. Parallel & Serial ports as standard. £349 (a)

NAT PANASONIC KX P3131
Daisy wheel printer with 38K buffer, 17 cps, bi-directional, parallel interface £249 (a)

JUKI 6100 Daisy wheel printer
15 cps, 2K buffer, switchable 10/12/15 cpi proportional spacing, underlining. Parallel interface. £295 (a)

Parallel Printer Lead (1.2m) £5 (d)

MODEMS

All modems listed below will be supplied with BBC Publications ModemMaster comms package and a BBC data lead.

MIRACLE WS4000 V21/23 £135 (b)

MIRACLE WS3000 V21/23 £244 (b)

MIRACLE WS3000 V22 £409 (b)

MIRACLE WS3000 V22 bis £537 (b)

(All modems are BABT approved)

BBC Data Cable for WS3000/4000 £7 (d)

MIRACLE WS2000V21/23 & BELL stds £92 (c)

WS2000 Auto Dial Card £27 (d)

WS2000 Auto Answer Card £27 (d)

WS2000 SK1 Kit £5 (d)

WS2000 User Port Lead £5 (d)

TIME WARP

Real Time Clock. Plugs into the user port, battery back up as standard, includes manual, demo software including a diary/planner application program £29 (d)

PLOTTERS

Hitachi 672XD A3 4 Colour HPGL (variety of pens available) £465 (a)

Plotmate A4S £282 (a)

Plotmate A3M £431 (a)

Larger Plotters available. Please enquire.

PRINTER SHARERS & BUFFERS

TSB256 Printer Sharer Buffer
Provides a massive buffer size of 256K and connects three computers to one printer. Autoswitching between computers, facility to print copies. £189 (b)

BUFFALO PB Buffer
Parallel buffer for internal fitting to most Epson printers. Simple to instal.
PB128 (128K) £89 (c)

PERIPHERAL & COMPUTER SHARERS
High quality switches to allow the user to switch between computers, printers, modems etc. Fully shielded metal cases. all lines fully switched.

		Parallel		Serial
2 Computers to 1 Printer	36v36-2	£25(c)	25v25-2	£25(c)
3 Computers to 1 Printer	36v36-3	£39(c)	25v25-3	£39(c)
4 Computers to 1 Printer	36v36-4	£45(c)	25v25-4	£45(c)
2 Computers 2 Printers X-over	36v36-x	£49(c)	25v25-x	£49(c)
BBC Cable set 3 to 1 (1m ea)		£24(c)		
BBC Cable set 4 to 1 (1m ea)		£30(c)		

BBC Computer Sharer: TCS26
1 computer to 2 printers fitted with BBC cable £17 (c)

Paper & Labels
Plain fanfold paper with microperforation:
2000 sheets 9½ × 11" £12 (£3.50)
2000 sheets 14½ × 11" £18.50 (£4.50)
1500 sheets A4 90gsm £18.00 (£4.00)

Labels/1000
Single Row 3½ × 1 7/16" £5 (d)
Triple Row 2 7/16" × 1 7/16" £5 (d)

PROGRAMMING ACCESSORIES/SOFTWARE

Compatible with B, B+ and Master

EpromRyter (Epromer II)
Eprom Ryter is compatible with BBC Master only. See page 7. £119 (b)

Upgrade of Epromer II to Eprom Ryter (Please return your Epromer II) £49 (b)

EPROMER II £89 (b)

MPROMER £49 (c)

META ASSEMBLER £145 (b)

PORTAL EPROM EMULATOR 512K £245(b)

TEAM Disassembler £145 (b)

EPROM ERASERS
UV1B 6 eproms, safety cutout £47 (b)
UV1T 6 eproms, timer, safety cutout £59 (b)

MONITORS

BBC lead incl with all monitors

MICROVITEC 14" RGB Monitors
Please specify plastic or metal case.

Microvitec 1431
Standard Resolution 453 pixels £179 (a)

Microvitec 1431AP
As 1431 + composite video and sound input £199 (a)

Microvitec 1451
Medium Resolution 653 pixels £225 (a)

Microvitec 1451AP
As 1451 + composite video and sound input £255 (a)

Microvitec 1441
High Resolution 895 pixels £359 (a)

Philips 14" RGB
Med Res, high contrast screen, TTL/Linear Input, Mono/Colour Switch Sound Input. Seperate controls for brillance and contrast. £195 (a)

Microvitec 20" RGB/PAL/Audio Monitors

Microvitec 2030CS
Standard Resolution RGB/Comp Video £380 (a)

Microvitec 2040CS
High Resolution RGB/Comp Video £685 (a)

TOUCHTEC-501
Brings genuine touch screen operation on metal cased Microvitec monitors, incl utilities disc with starter and development programs £239 (b)

TAXAN SUPER VISION 620
12" Hi Res/Hi Contrast
Option to switch to green/amber
BBC/IBM Compatible £269 (a)

TAXAN SUPER VISION 625
12" Super Hi Res and contrast RGB Monitor with option to switch to mono BBC/IBM compatible. £319 (a)

12" MONOCHROME MONITORS

TAXAN KX 117
Hi Res green etched screen £85 (a)

TAXAN KX 118
Hi Res Long Persistence (P39) £90 (a)

TAXAN KX 119
Hi Res amber etched screen £90 (a)

PHILIPS BM 7502
Hi Res green screen. £69 (a)

PHILIPS BM7522
Hi Res amber screen. £75 (a)

PHILIPS BM 7542
Hi Res White screen. £79 (a)

MONITOR ACCESSORIES
Microvitec Swivel Base (14" plastic monitors) £17 (c)
Philips Swivel Base £10 (c)
Monitor Stand Models B & B+ £10 (c)
Monitor Stand Master £13 (c)
Double Tier stand Models B, B+ or Master £24 (b)
Taxan RGB Lead £5 (d)
Microvitec Lead £3.50 (d)
Monochrome BNC/Phono Lead £3.50 (d)

TECHNOLINE
(24 hr viewdata system)
Tel:01-450 9764

MAIL ORDER
17 Burnley Road
London NW10 1ED
Telex:922800

RETAIL SHOPS
15 Burnley Road, London NW10 1ED
Tel:01-208 1177 Telex:922800
(close to Dollis Hill ⊖)
West End Branch
305 Edgware Road, London W2
Tel:01-723 0233
(near Edgware Road ⊖)

For fast delivery telephone your order on 01-208 1177 using VISA/Access Card

BARCLAYCARD VISA · ACCESS

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All prices ex VAT.
Prices are subject to change without notice
Please add carriage
(a) £8.00 (Datapost)
(b) £2.50
(c) £1.50
(d) £1.00

CAD/DRAWING PACKAGES

NOVACAD
Cad Package for B, B & MASTER.
(See page 5 for specification)

Tracker Ball/Mouse Version (TM)	£49 (d)
TM Version plus Tracker Ball	£94 (d)
TM Version plus Mouse	£79 (d)
Plotter Driver Generator	£15 (d)

MOUSE

AMX MOUSE with SUPER ART (pse specify B, B+ or Master)	£59 (d)
STOP PRESS (Pagemaker)	£32 (d)
EXTRA/EXTRA (utility for the Pagemaker)	£19 (d)
MAX	£17 (d)
STAND ALONE MOUSE (includes horizontal scroll lock)	£34 (c)

RB2 TRACKER BALL

RB2 Tracker Ball with Icon Master (for B, B+ & Master)	£59 (c)
RB2 Tracker Ball with Cursor Control Rom (for Master only)	£59 (c)
RB2 Tracker Ball 'Stand Alone' for use with NOVACAD & other software)	£47 (c)
Cursor Control Rom for Master	£12.50 (d)
MIRRORSOFT FLEET STREET EDITOR	£35 (d)

CP/M SOFTWARE

Send for details on our full range of CP/M & PC DOS packages for Business, Communications & High Level Languages.

Please send for details on our range of CP/M software for Acorn/Torch Z80 2nd Processors

BBC SOFT/FIRMWARE

*All software supplied by us is known to operate with the appropriate Acorn Disc filing systems. We **cannot** comment on their use with other DFS systems.*

DATABASE MANAGEMENT SYSTEMS

VIEWSTORE	£37 (d)
STARdataBASE	£39 (d)
MASTERFILE II	£17 (d)
ACORN OVERVIEW PACKAGE Special Offer (RRP £86)	£57 (b)

WORD PROCESSORS

ACORN VIEW PROFESSIONAL (BBC)	£85 (c)
VIEW 2.1	£35 (d)
VIEW 3.0	£48 (c)
VIEW INDEX	£12 (d)
VIEW PRINTER DRIVER GENERATOR	£7 (d)
VIEWSPELL	£29 (d)
DOT PRINT PLUS	£28 (d)
WORDWISE	£24 (d)
WORDWISE PLUS	£38 (d)
WYSIWYG PLUS	£21 (d)
SPELLMASTER	£47 (d)
INTERWORD	£39 (d)
WORDEASE	£24 (d)
SPELLCHECK III	£31 (d)
EDWORD II	£43 (c)

SPREADSHEETS

VIEWSHEET	£37 (d)
WINDOWMATIC	£15 (d)
VIEWPLOT	£22 (d)
INTERSHEET	£37 (d)
INTERCHART	£26 (d)
ULTRACALC	£26 (d)

MINI OFFICE II DISC Version

For B & B+ 40T or 80T	£14.75 (d)
For Master 80T	£17.30 (d)
For Compact	£19 (d)

MINI OFFICE II ROM Version

For Master, Compact, B+ & B	£48 (c)

LANGUAGES

META ASSEMBLER	£145 (b)
TEAM DISASSEMBLER	£145 (b)
MACROM	£33 (d)
ACORN MICRO PROLOG	£62 (d)
ISO-PASCAL	£51 (c)
ISO-PASCAL STAND ALONE GENERATOR	£30 (d)
OXFORD PASCAL (40 or 80T) Specify B or B+	£36 (d)
OXFORD PASCAL for Master	£52 (d)
ACORN LOGO	£46 (c)
LOGOTRON LOGO	£55 (c)
BBC PUBLICATIONS OPEN LOGO	£59 (c)
ACORN LISP ROM	£39 (d)
ACORN FORTH ROM	£39 (d)
ACORN COMAL ROM	£39 (d)
MICROTEXT	£52 (c)
MICROTEXT PLUS	£229 (b)

COMMUNICATIONS

TERMULATOR	£25 (d)
COMMSTAR II	£28 (d)
COMMUNICATOR	£49 (d)
MODEM MASTER	£11 (d)
COMMAND	£34 (d)
MASTER TERMULATOR	£34.75 (d)

UTILITIES

ACCELERATOR	£49 (d)
ACORN BASIC EDITOR	£24 (d)
MONITOR (BBC Pub)	£19 (d)
BROM PLUS	£26.50 (d)
SLEUTH	£23 (d)
TOOLKIT PLUS	£31 (d)
TOOLBOX 2 (BBC Pub) Manual	£9.50 (d)
Cassette	£9 (d)
ACORN GXR GRAPHICS ROM specify B or B+	£24(d)
PRINTMASTER	£24 (d)
PRINTWISE	£24 (d)
DUMPMASTER	£26 (d)
FONTWISE PLUS	£17 (d)
HERSHEY FONT CHARACTER GENERATOR	£18 (d)
ICON MASTER	£29 (d)
MOVIE MAKER Two Roms + Cassette	£26 (d)
ADV TELETEXT UTILITIES ROM	£7.95 (d)

COMPACT (all on $3\frac{1}{2}''$ disc)

ARTROOM	£27 (d)
FONTWISE+	£22 (d)
FONT EDITOR	£22 (d)
RAMROD	£37 (d)
BROM PLUS	£32 (d)
MACROM	£37 (d)
BETABASE	£27 (d)
WHITE KNIGHT MKII	£16 (d)
BBC PUBLICATIONS BUNDLED SOFTWARE	£18.50 (d)

BBC PUBLICATIONS EDUCATIONAL SOFTWARE

A series of programs developed in many cases alongside Radio & TV programmes by BBC's Education Department which supplement the classroom studies by moving and colourful displays helping in clear understanding of a variety of subjects. Some packages also include audio cassettes.

PRIMARY EDUCATION

ASTRONOMY		£11 (d)
COMPUTERS AT WORK	Aud/EC/disc	£16 (c)
PICTURE CRAFT	Disc	£17 (d)
INTRODUCING GEOGRAPHY	Disc	£16 (d)
MATHS WITH A STORY 1	Cass	£8 (d)
MATHS WITH A STORY 2	Cass	£8 (d)
NUMBER GAMES	Cass/EC	£7.50 (d)
USING YOUR COMPUTER	Cass	£24 (c)

SECONDARY LEARNING

TECHNOLOGY & DESIGN Pt1		£21.50 (c)
ELECTRIC FIELDS		£10.50 (d)
ADVANCED LEVEL STUDIES: STATISITICS	Disc	£23 (d)
ADVANCED STUDIES: GEOGRAPHY	Cass	£10 (d)
INSIDE INFORMATION	Prog Cass	£10 (d)
	Book £8 (d) Audio Cass	£5 (d)
SCIENCE TOPICS (ST)		
S.T.:WAVES	Disc	£14 (d)
S.T.:RELATIONSHIPS	Disc	£14 (d)
S.T.:BONDING	Disc	£14 (d)
S.T.:ELECTROMAGNETIC SPECTRUM	Disc	£14 (d)
S.T.:ELECTRONICS IN ACTION	Disc	£14 (d)
S.T.:NEWTON & THE SHUTTLE	Disc	£19 (d)
S.T.:ECOLOGY	Disc/EC	£19 (d)
S.T.:POLYMERS	Disc/EC	£19 (d)
S.T.:CLASSIFICATION & PERIODIC TABLE	Disc	£20 (d)
S.T.:FOOD & POPULATION	Disc	£20 (d)
SEC.SCIENCE MICROTECHNOLOGY	Cass	£7 (d)
SEC.SCIENCE:THE MOLE CONCEPT	Disc/Aud/EC	£16 (c)

GENERAL

VU-TYPE PROFESSIONAL	Disc	£19 (d)
WHITE KNIGHT MK II (for compact)	Disc	£16 (d)
BATTLEFIELDS	Cass	£8.50 (d)
A VOUS LA FRANCE	Cass/EC	£17 (d)
	Book	£5.25 (d)
	Audio Cassettes (2)	£7.50 (a)
Additional charges for discs		£9.00 (d)
DEUTSCH DIREKT	Disc/aud/EC	£16 (c)
	Book	£5.95 (d)
MODEM MASTER		£11 (d)

Cassette based programs listed above can be supplied on disc at an extra charge of £1.50 per disc and please specify the format required 40 or 80T.

TECHNOMATIC

BBC COMPUTERS & ECONET CENTRE
17 Burnley Road, London NW10 1ED Tel: 01-208 1177
305 Edgware Road, London W2 Tel: 01-723 0233

BOOKS

No VAT Carriage Code (c)

LANGUAGES
6502 Assy Lang Prog £19.95
6502 Programming £13.95
8086 Book £23.95
Acorn BCPI User Guide £15.00
Acorn FORTH £7.50
Acorn LISP £7.50
Acorn ISO Pascal Ref Manual £10.00
Intro to COMAL £10.00
Intro to LOGO £7.50
Micro Prolog Ref Manual £10.00
Introduction to Turbo Pascal £14.95
Prog the Micro with Pascal £8.50
The Supervisor's BBC Micro £10.95

BBC MICRO GUIDE BOOKS
Inside Information £8.95
Maths Prog in BBC Basic £7.95
The Friendly Computer Book £4.50
Toolbox 2 .... £10.95

PROGRAMMING/UTILITY
Advanced Sideways Ram User Guide £9.95
Advanced User Guide (BBC) £15.95
Applied Assembly Language on the BBC £9.95
BBC Micro Advance Programming £9.95
BBC Micro Ref Guide (B Smith) £10.95
BBC Micro Sideways ROM's RAM's £9.95
Guide to the BBC Rom £9.95
Beginners Guide to W.P. £7.95
Mastering Assembly Code £8.95
Mastering Interpreters & Compilers £14.95
Mastering View, Viewsheet & Viewstore £12.95
View by B. Smith £12.95
View 3.0 User Guide £9.00
Viewstore User Guide £9.00
Viewsheet User Guide £9.00
Wordwise Plus £9.95

SOUND & GRAPHICS
Computer Graphics & CAD Fundementals £9.95
Mastering Music £6.95

DISC DRIVE SYSTEMS
Advanced Disc User Guide £16.95
Disc Book £3.50
Disc Programming Techniques £7.95
Disc Systems £6.95
File Handling on the BBC £6.95
Discovering Disc Drives .... £POA
Practical Disc File Techniques £5.95
Mastering the Disc Drive £12.95
Mastering DOS plus £12.95

APPLICATIONS
Interfacing Proj for BBC £6.95
BBC and Small Business £5.75
The Software Business £5.50

Mastering Operating System (David Atherton) £12.95

WYSIWYG PLUS

WYSIWYG PLUS is a printer and screen utility for Wordwise Plus, View, Interword, and Basic users, supplied on a 16K Eprom. To obtain a particular printer effect, such as enlarged text, it used to be necessary to discover the appropriate 'printer control code' from your manual and incorporate it into your text. Secondly, you had to print several trial copies in order to position the effect correctly in relation to the rest of your text.

WYSIWYG PLUS simplifies this trial and error approach using easily remembered *commands. For example, *ENLARGED not only selects enlarged text on your printer, but uniquely shows you double width characters on your screen, even from within Wordwise Plus!

WYSIWYG PLUS incorporates a logo editor. Just draw your design on screen using the arrow keys, and save the results. Use the *GRAPHICS command to incorporate your design anywhere in your text; position and see your design in your text before faithfully reproducing a hard copy.

There is also special help for daisy wheel users. The *WHEEL command will prompt you to change daisy wheels whenever a change in type style is about to occur.

WYSIWYG PLUS is designed to work with the following systems:

BBC Model B
BBC Model B+
BBC Master 128
BBC Compact
6502 Second processor,
Turbo coprocessor
All printers (Except lasers)

WYSIWYG PLUS workspace is relocatable.

WINDOWMATIC

All users of Acorn's VIEWSHEET speadsheet program will be aware of its powerful windowing facility which allows the screen and/or printer to be configured in up to 10 seperate windows taken from anywhere in the sheet. They will also be painfully aware of how difficult and time consuming it is to set up a required display. Although VIEWSHEET allows configurations to be saved to the media, it does not have provision for deciphering them.

WINDOWMATIC has been produced with the intention of rectifying these shortcomings and to bring out the very best from VIEWSHEET.

WINDOWMATIC provides a quick and easy way to configure screen and printer allowing complicated documents and reports to be set up much more easily. It displays complete text information on all 20 windows and accurate graphic representation of the screen and printer output.

The package includes a screen dump routine for Epson printers and allows use of other printer dump packages.

WINDOWMATIC is compatible with BBC Master and BBC B+. A 6502 2nd processor must be fitted to a model B to run Windowmatic. Windowmatic is fully compatible with Turbo and 6502 2nd processor.

The program is supplied on disc with a comprehensive manual.

VU-TYPE

Do you have finger trouble when typing?
Do your letters look like this?

Dear Sor,
I wuold like to .....

then you need:

VU-type, a complete touch typing program produced by BBC/Pitman.

It allows you to learn at your own pace and has a wide range of exercises. Screen displays show the keys you have pressed and it will report on your speed and accuracy.

Supplied on a 40T Disc with a manual.

Available at a special price of £7.50(d) instead of the usual £15. Offer valid while stocks last

EDUCATIONAL/FUN SOFTWARE BUNDLE

Wordmover
Wordplay
Pantry Antics
Drawstick
Locomotion

These programs are supplied from the BBC Publications Educational Software range and will be supplied on a 5.25" disc for BBC Master, B+ and B and on a 3.5" disc for the Compact.

5.25" Disc £17.50(d)
3.5" Disc £18.50(d)
(Normal RRP over £40)

PRINTER ACCESSORIES

EPSON ACCESSORIES:
Interfaces
8143 RS232 .... £30 (d)
8148 + RS232 + 8k .... £65 (d)
8177P NLQ for FX80 +/FX100 + ... £99 (d)
Parallel & Serial Buffers of various size also available.
LQ800 Tractor Feed .... £47 (b)
LQ1000 Tractor Feed .... £52 (b)

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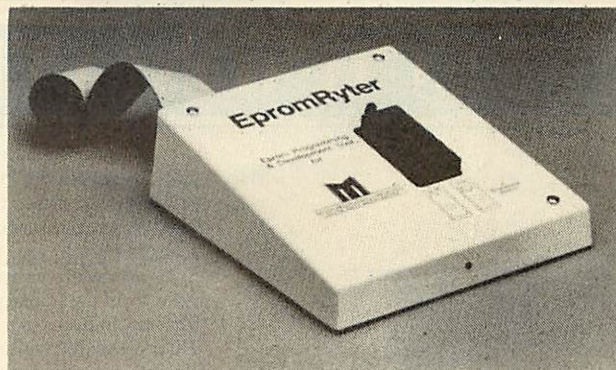
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Some of the above features apply to Master Computers only

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- Emulates 2716, 2732, 2764, 27128, 27256, 27512 eproms at 150ns Access time.
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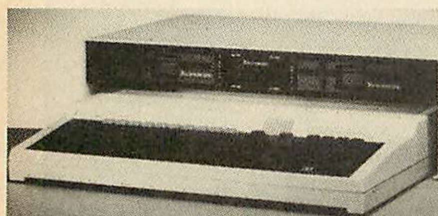
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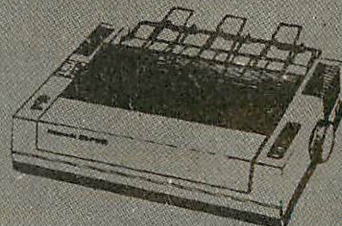


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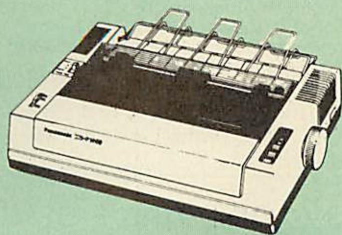
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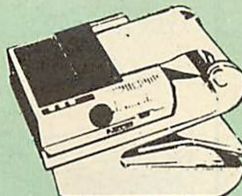
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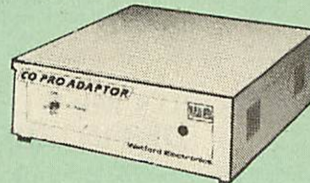
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It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

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If you already have the Watford Electronics DFS and wish to incorporate these new facilities then simply return your existing DFS ROM to us together with £5 remittance for an upgrade. Please pack the ROM securely and address the package to our Upgrades Dept.

WATFORD's & ACORN's SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for five years and has gained a large following amongst serious and educational users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. ***(P.S. Watford's highly sophisticated DFS is fully compatible with Acorn DFS). (not Acorn's 1770 DFS)***

- *Complete Disc Interface Kit including DFS ROM and fitting instructions* **£46**
- *Acorn's 0.90 DFS Kit complete* **£45**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**
  (P.S. Our comprehensive DFS Manual covers both Acorn & Watford DFSs).
- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DNFS ROM only* **£17** ● *ADFS ROM only* **£25**
- *Watford's DFS is exclusively available from Watford Electronics and their appointed dealers only. Every ROM carries a special label with LOGO and serial number.*

NEW WATFORD's Mk II Double Density DFS INTERFACE

Many of our customers have wanted to use our superior DDFS and Acorn ADFS together. Now our MkII DDFS board has been adapted to allow the use of Acorn ADFS.

Added features include:
- Acorn ADFS compatible – Use ADFS on our DDFS board.
- Tube host Code – No longer any need to have the DNFS in your machine to use Co-Processors, even the CoPro and Master 512.
- Auto 40-80 Track sensing – no need to fuss with 40/80 track switches (even works with protected disks).
- An extremely powerful 8271 emulation – ensuring compatibility with almost all software.
- New low profile – small footprint board.
- Fits with all third party ROM boards.
- Option to double the speed of file handling operations – BPUT and BGET
- Operates in both single and double density modes.
- OSGBPB has been recoded, increasing still further the speed of file handling.

Please note that not all DDFS's are capable of providing either the full 80% storage increase or of allowing a file the full size of the disk – Ours allows both of these!
If you already have a DDFS (any manufacturer), and wish to upgrade to our MkII version, then simply return your existing ROM and DDFS board and we will supply the new DDFS for only **£25.00.**

- Special introductory offer **£39.00**
- DDFS Manual (No VAT) **£6.95**
- We will exchange your existing DFS Kit for our sophisticated DDFS for only **£25.00**

Please note, as the MkII DDFS is a hardware and software upgrade, it is not possible for existing Watford DDFS users to simply exchange their ROM for the new version.

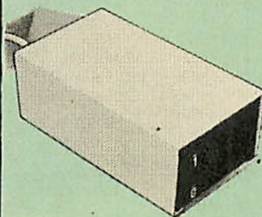
SPECIAL DISC DRIVE/DDFS OFFER

Type CLS400



- The popular Mitsubishi 400k Single Disc Drive, Double Sided, cased with Cables. Plugs directly to your Micro.
- Watford's popular DDFS Disc Interface (allows 720k storage). Will run in both Single and Double Density modes 40/80 track Software switchable.
- A comprehensive User Friendly Manual.

A Bargain at Only **£125** (£6 carr)
(Offer valid while stocks last)



3½" DISC DRIVE OFFER

These top quality 3½" Double sided, 80 track, 1 Megabyte (unformatted each Disc Drives), are attractively finished in BBC beige. They are supplied complete with all cables and a Utilities Disc. They run directly from the BBC B/Master's own PSU.

- Single 400K Drive **£69**
- Twin 800K Drives **£126**

MYSTERIES OF DISC DRIVES & DFS REVEALED (BOOK)

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.
Then The Mysteries of Disc Drives and DFS Revealed is the book for you. It explains in detail the different types of systems available, how they are installed and how to use them. Many examples are given including pre-written programs to call various functions of the DFS available only through Operating System calls. Different types of disc, 40/80 tracks etc. are all explained. This book is ideal for the beginner confused by the plethora of choice available in the marketplace.

£5.95 (Book No VAT)

DISC ALBUMS

Attractively finished in antique brown leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

FLOPPY HEAD CLEANER KIT

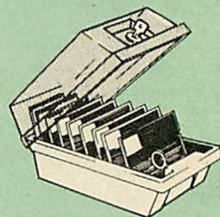
The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use. Available in 3½" & 5¼", please specify.

£7

ANTISTATIC LOCKABLE DISC STORAGE UNITS

Gives double protection – Strong plastic case that affords real protection to your discs. Antistatic helps avoid data corruption whilst in storage. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

- **M35** - holds upto 50 5¼" discs **£6.50**
- **M85** – holds upto 95 5¼" discs **£8.00**
- **M25** – holds upto 25 3 ½" Discs **£5.50**
- **M50** – holds 50 3½" Discs **£7.50**





PLASTIC LIBRARY CASES

Holds up to 10 5¼" Discs. **Only £2.00**

PLONKER BOX

When using ones micro, there is a tendancy to have more than one Disc on the desk. This exposes them to the hazards of fingerprints, scratches, dust, coffee and an untidy desk.
Why not protect your valuable data from all these hazards with the help of our extremely handy and low cost PLONKER BOX. It holds up to eight 5¼" Discs.



Protection at Only: **£2**

DUST COVERS (For our Disc Drives)

Single CLS (without PSU) **£3.20** Twin CLD (without PSU) **£3.85**
Single CS (with PSU) **£3.95** Twin CD (with PSU) **£3.90**

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates capacity in single density mode. That within the brackets is the capacity in double density mode. All disc drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). All our 80 track drives are already fitted with a 40-80 select switch.

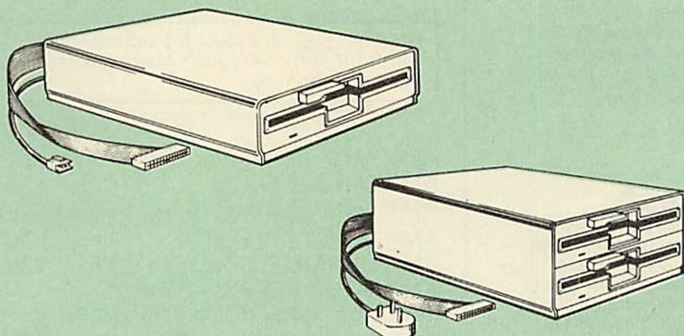
All our Disc Drives are Double Sided and will operate in both Single and Double Density modes. *Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

Various other "manufacturers" of disc drives for the BBC micro (more accurately, "packages" label other manufacturers drives with their own name). We buy the high quality JVC and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate (extensive tests within our workshops have confirmed this). All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. Ideal for Schools & Colleges. We are now able to supply all single disc drives with Power Supply, in either single or dual case. (Dual case has a twin data cable and a power supply capable of driving two disc drives) allows easy expansion to a dual drive unit, at a later date. Prices stated in the pricing boxes below are for single drives in standard single cases. Single drives in a dual case cost an extra £5. (At Watford we anticipate your needs of tomorrow, not just today)!

When using a BBC Micro, most people find themselves short of desk space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space) your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 6th page of our advert for the Plinths).
P.S. All our 5¼" Disc Drives with PSU are compatible with the Compact Micro. All you require is the special Compact Disc Drive Cables designed by us.



Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
200K (360K)	CLS 200 £89		CS 200 £98	
400K (720K)	CLS400S £89	CLD 400 £174	CS 400S £99	CD400 £188
800K (1.44M)		CLD 800S £175		CD 800S £189

● TWIN Disc Drive Case, complete with Power Supply & Cables **£43**
Securicor carriage on Disc Drives £5 to £6

*Prefix **C** = Cased Drive*
***L** = Less PSU*
***S** = Single*
***D** = Double*

*Suffix **S** = 40-80 Switchable*

e.g. CLS400S = Cased Disc Drive, Less power supply unit, single 5¼" 400K, (720K in double density); Double sided; 40/80 track switchable.

Cable to connect 5¼" Disc Drives to BBC Compact
Single £9 Twin £12
Special Cable to connect both 3½" and 5¼" Disc Drives simultaneously to the BBC Compact £13

3M – DISKETTES

3M – SCOTCH Diskettes with Lifetime warranty from Watford Electronics your 3M Appointed Distributor.

- *10 × 5¼" S/S D/D 40 Track Diskettes* ***£8.50***
- *10 × 5¼" D/S D/D 40 Track Diskettes* ***£10.50***
- *10 × 5¼" S/S D/D 80 Track Diskettes* ***£13***
- *10 × 5¼" D/S D/D 80 Track Diskettes* ***£13***
- *10 × 5¼" 1.6M D/S D/D High Density Discs for IBM XT and AT* ***£28***
- *10 × 3½" S/S D/D 40/80 track Discs* ***£15***
- *10 × 3½" D/S D/D 40/80 track Discs* ***£19.50***

TOP QUALITY 3½" & 5¼" DISKETTES

To complement the range of quality discs and disc drives that WE already sell, WE are now supplying some special offer packs of 10 high quality discs. Each Disc has a reinforced hub ring and carries a lifetime guarantee. These are supplied complete with selfstick labels and packaged in an attractive plastic library disc box to protect them from damage. We strongly recommend these Discs.

DON'T SETTLE FOR LESS, BUY THE BEST

- *10 × **M3** 3½" D/S D/D 80 Track Discs* ***£18***
- *10 × **M4** 5¼" S/S D/D 40 Track Discs* ***£7***
- *10 × **M5** 5¼" D/S D/D 40 Track Discs* ***£9***
- *10 × **M7** 5¼" D/S D/D 80 Track Discs* ***£11***
- *3" Double Sided Discs* ***£3 each***

Special BULK OFFER on 5¼" DISCS

PRICES SLASHED

(Supplied packed in Anti-Static Lockable Storage Units)
(Lifetime warranty on Discs)

BULK PACK DISCS in lots of 100

Type	S-S 40T	D-S 40T	D-S 80T
● Without Sleeves	£35	£39	£45
● With Sleeves	£38	£42	£48

ACORN WINCHESTER DRIVES

Supplied complete with Level 3 Econet File Server software.
20 Megabytes **£699**; **30 Megabytes £1549**

WATFORD's WINCHESTER DRIVES

PRICES SLASHED

- 10 Megabyte Unit with ADFS **£399**
- 20 Megabyte Unit with ADFS **£499**
- 40 Megabyte Unit with ADFS **£749**

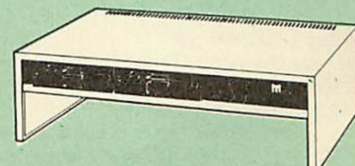
CDP800S **CDPM800S**



Twin 800K Double sided 40-80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The switches are mounted on the front panel for ease of use.
In response to popular demand, we are now able to offer a 3½" and a 5¼" disc drives mounted in a similar plinth as above for both, BBC and Master microcomputers. This new Disc Drive type number is DP35-800S.

CDP 800S for BBC Micro £199
CDPM 800S for Master £205
DP35-800S for BBC/Master £175
(Securicor Carr. £7)
(The above drive units are 2 Megabytes unformatted)

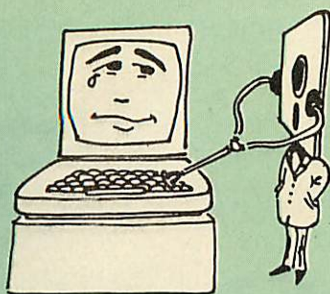
ACORN'S Twin 800K Disc Drives



Specially mounted side by side in a Master Plinth. Supplied complete with Cables. Plugs directly to the Master Computer.

RRP ~~£250~~ **Our Price: Only £189** (carr £7)

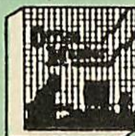
DIAGNOSTICS DISC



The BBC Micro is a very complex machine and thus diagnosing a fault can be very difficult. At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.
The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:
RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.
This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

OFFICE MASTER



CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.
FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.
MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.
EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.
INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.
STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21** (Disc)

OFFICE MATE



- DATABASE
- BEEBCALC SPREADSHEET
- BEEBPLOT GRAPHICS

DATABASE – Set up a computerised card index system with powerful search facilities.
SPREADSHEET – Offers many calculation and editing features.
BEEBPLOT – Provides visual representation from Spreadsheet data.

OFFICE MATE Only £10 (Disc)

TED

THE ULTIMATE TELETEXT SYSTEM

TED is one of a new generation of powerful 32K ROMs for the BBC B, B+ and Master computers and is compatible with disc, tape and network systems. It is in everyday use in schools, colleges and universities, Programmers, Prestel I.P.'s, Micronetters and exhibitors have also found it indispensable.
TED includes the most comprehensive teletext (Mode 7) screen editor ever written for the BBC micro, combining flexibility with ease of use. Its sophisticated facilities include line, column and block copying within AND between frames; text, in a variety of styles and sizes, entered directly from the keyboard; graphics and line drawing modes; search and replace; margins; printer dump routines and a library of in-built icons and typefaces. TED will edit ANY mode 7 screen and can even convert high-res graphics screens to mode 7! Included within the ROM is a fully Epson compatable mode 7 graphics dump routine giving a grey scale printout of exactly what appears on the screen.
Using '*SHOW' (a versatile carousel), collections of mode 7 screens may be 'routed' or displayed sequencially, making it ideal for creating and running 'Viewdata' information systems. Over 1200 frames may bestored on a twin 80 track drive. A unique feture of TED is '*SCROLL', which lets you create pages of up to 600 lines which may be viewed 'Wordwise style', automatically or manually. SHOWs and SCROLLs may be freely mixed and even used from within a BASIC program.
The package comprises a 32K ROM, a 117 page manual, a function-key strip and a demonstration disc containing examples of real-time animation and a sample 55-frame database. A stand-alone machine code routine is provided allowing SHOWs and SCROLLs to be displayed on machines not fitted with TED.

Price: £35

ROM-SPELL

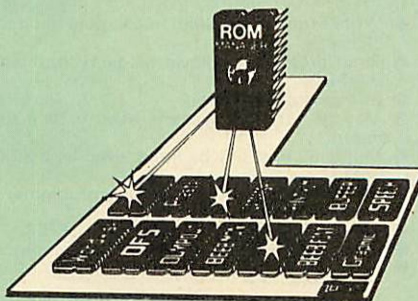


Probably the most advanced and fastest spelling checker available for the BBC Micro. Compatible with View, Wordwise and Wordwise Plus ROMSPELL is simple to use with easy editing of incorrect words. Full facilities for editing the user dictionary to allow customisation to your personal needs. Dictionary includes over 30,000 words and is supplied with a Comprehensive manual.

NOT compatible with 1770 DFS.
(Please state 40 or 80 track disc)

Price still only: £25

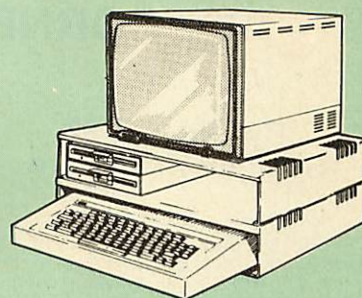
ROM MANAGER



Take control of your Sideways ROMs with ROM Manager. This powerful utility ROM gives you power over your sideways ROMs. Disable whole ROMs, send commands directly to named ROMs and many other powerful facilities.
"Provides comprehensive management of all your installed ROMs". (BEEBUG November '84.)

ONLY £20

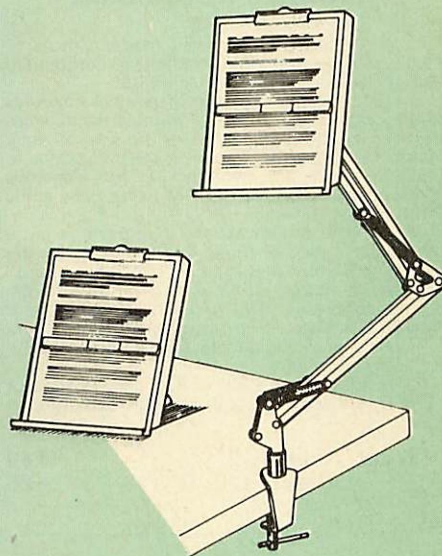
PLINTHS FOR BBC MICRO, MASTER & PRINTERS



Protect your computer from the weight and heat of your monitor. The BBC micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and monitor, whilst the double height version provides enough room for our stacked or side-by-side dual disc drives or TORCH Disc pack, to be placed in the centre section. If you use our stacked drives, the remaining space can be used for further peripherals e.g. Speech Synthesizer, EPROM programmer or simply stationery. The computer slides neatly in to the lower section allowing easy access to remove the lid. The printer plinth is equally sturdy but without the cooling slots. It allows for access to the paper from the front as well as from the rear, (a facility not often thought of in similar products) if the paper is located beneath the plinth. This is a very convenient way to work especially if your work area is not deep enough to take the printer and paper separately.

SINGLE BBC PLINTH	**£11** (carr. £1.50)
DOUBLE BBC PLINTH	**£19** (carr. £3.00)
PRINTER PLINTH	**£10** (carr. £1.50)
SINGLE MASTER PLINTH	**£14** (carr £1.50)
DOUBLE MASTER PLINTH	**£24** (carr £3.00)

COPY HOLDERS



How often have you been about to type hand written notes into your computer when you find that there's nowhere to rest the paper or that your notes are resting at the wrong angle to read the type? Whether the notes be your latest program or the draft of a new trilogy, the new Manuscript Holders from Watford are superb for holding your paper at the ideal height and angle to allow you read and type in ease and comfort.
Available in 2 versions, desk resting and shelf clamping versions, these two units hold your paper firmly by means of a plastic retaining ruler and a clip grip. Both units are full A4 size.

Amazing value at only
Desk Top **£10** (carr. £2)
Angle poise **£14** (carr. £3)

Continued →



ARIES CORNER

The Aries B-32 Shadow RAM Card

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus, Interword and many other applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the 6502 processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

Price: **£80** (carr. £2(

Aries B-12 Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries-B20 and the Aries-B32

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on the board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable "mother board" which carries the extension ROM sockets and a small "base board" on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have a B32 or B20, a small adaptor module (the Aries-B12C) is available at a nominal cost.

Price:	Aries B-12	**£40**
	Aries B-12C	**£5**

ARIES B-488 IEEE-488 INTERFACE UNIT

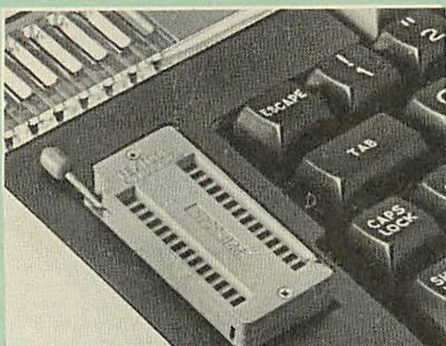
The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

£238 (Carr £3)

GRAPH PAD 2

Supplied complete with Software
£60 (Carr. £3)

SIDEWAYS ZIF SOCKET



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)
- BBC, B+ and Master compatible.

ONLY **£15** (carr £2)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack.

● Complete System	**£11**
● Spare Cartridges	**£2.50**
● Spare Rack	**£1.50**

16K Sideways RAM Modules

Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

- Write protection (useful in a variety of circumstances).
- Read protection (allows recovery from ROM crashes).
- Compact construction.
- May be fitted in systems even with a ROM board.
- Multiple units may be fitted, even with a ROM board.
- No overheating or overloading problems.
- Free utilities disc supplied.
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

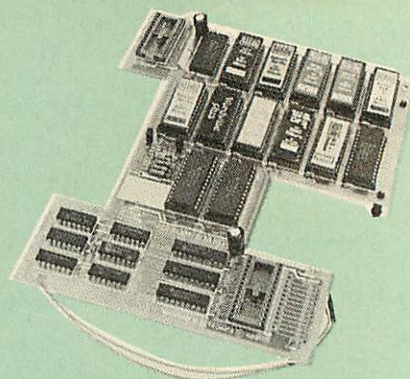
Only: **£24** (carr £2)

Optional extras

READ and WRITE protect Switches **£2** each
Battery for Battery Backup **£3**

All prices in this advert are exclusive of VAT.

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16.

Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

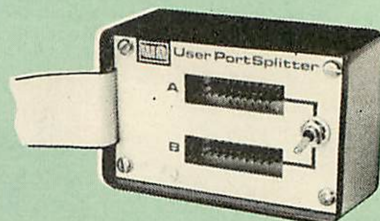
- The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 takes two 6264 RAM chips.
- Read protect to make RAM "Vanish") allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £32
Battery backup fitted **£36**
(carriage £2)

- Sideways RAM Utilities Disc for Solderless ROM Board. Includes the options to load and save ROM Images and the facility to use Sideways RAM as Printer Buffer.

Only: £8

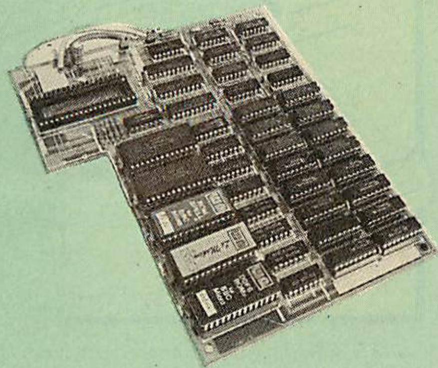
USER PORT SPLITTER UNIT



Gone are the days when you had to plug and unplug devices from the User Port. This extremely useful little device allows two units to be connected to the User Port simultaniously, and select between them simply by toggling a switch. This device is particularly useful for those people using Quest Mouse and the Watford Video Digitiser or any similar combination.

Excellent Value at **£19**

ROM/RAM CARD



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM-RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM-RAM Board.

The ROM-RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, for later.

Please write in for further details.

INTRODUCTORY PRICES:

- ROM/RAM card with 32k dynamic RAM *£39*
- ROM/RAM card with 64k dynamic RAM *£52*
- ROM/RAM card with a massive 128k dynamic RAM *£80*

(carriage on ROM-RAM Card £3)

OPTIONAL EXTRAS:

- *16k plug-in Static RAM kit £6*
- *16k Dynamic RAM for Upgrade £7.50*
- *Battery backup £3*
- *Read and Write protect switches ...... £2 each*

Complete ROM-RAM board All options installed £89

P.S.
Is your existing ROM Board overflowing with ROMs? Do you need more Sideways RAM? Is your Board unreliable? Then upgrade to Watford ROM/RAM Board and pay £10 less

Le Modem



The MODEM from Watford

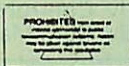
At last a professional MODEM for the BBC Micro. Unlike other 'Modem packages' this is a complete package there are no extra software costs to get 'up and running'. Of course Le MODEM is multi-standard, i.e. 300/300, 1200/75 & 75/1200 UK and BELL (USA) are all supported.

The features that make Le MODEM such good value are:

- *A complete communications terminal that transforms your BBC Micro into a very powerful World-wide data transfer system.*
- *Auto Dials, Auto answers, and is completely controlled by your micro. There are no external controls!*
- *Allows you to access PRESTEL, B.T. GOLD, THE SOURCE, MICROLINK, MICRONET, MICROWEB, THE TIMES NETWORK, MICRO LIVE (BBC TV database), CITY BB and more.*
- *Designed to be SIMPLE but SOPHISTICATED. To LOGON to a data base all you have to know is its TELEPHONE NUMBER, Le MODEM does the rest.*
- *Supplied with a comprehensive telecomms package in a 16K sideways ROM which includes a FULL PRESTEL terminal allowing TELE-SOFTWARE to be downloaded.*
- *A comprehensive 80 column terminal. This includes XMODEM error checked transfer protocol, to allow error free data transfer anywhere in the world!*
- *FULLY controlled by simple '*COMMANDS allowing you to control it from your own BASIC programs. To get you started we supply a FREE disc of bundled software!*
- *Connects to the 1MHz bus. A *AUDIO ON-OFF command allows you to actually hear the telephone line through your BBC micro loudspeaker.*
- *Completely self contained with internal mains power supply. (Even a free mains plug is fitted!) A *TEST facility gives ON SCREEN indication that Le MODEM is working correctly.*
- *Packaged in such as way that you need nothing else except a BBC Micro to communicate with computers all over the world.*
- ***FREE Registration to MicroLink.***

SPECIAL OFFER

Price: ***£84***
(carr £3)

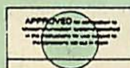


(Price includes, Le Modem, Software ROM, Cables & Comprehensive Manual)
(Write in for further details)

Nightingale Modem

SPECIAL PRICE to our Customers

£82

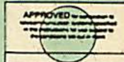


(Price includes: Nightingale Modem, Commstar ROM pack & Comprehensive manual)

Nightingale Modem without software	**Only £75**
COMMSTAR ROM package only	**£29**

(P&P on modem £3.00)

APOLLO



The NEW Modem from Watford

Following numerous requests from you, our discerning customers for an APPROVED, Low Cost & High Performance modem with Auto Dial & Auto Answer facilities as standard) we bring you the versatile APOLLO Modem. Just compare the features and look at the price (which incidentally includes the cost of the Software, manual and BBC connecting cable). We are sure you will agree that Watford Electronics in their traditional way are giving you a super 'value for money' deal.

Just look at these features:

- V21 for Bulletin boards, Microlink, Telecom Gold, etc.
- V23 for Prestel, Home Banking, and other Viewdata services.
- Reverse V23 allows User run Viewdata service.
- 1200-1200 half duplex for communications.
- XMODEM, HEX and ASCII file transmission.
- Auto Dial of given 'phone number.
- Auto Answer for User's Bulletin Board.
- 80 column terminal with split screen facility.
- Prestel text screen dump.
- Fully BABT approved.
- **FREE Registration to MicroLink.**
- **FREE £5 off Micronet Annual Subscription including Prestel and Telecom Gold.**

The Apollo is attractively finished in matt black. It opens the doors to world communication to both, the Hobbyist and the Professionals alike. With baud rates varying from 300/300 Originate and Answer, 1200/75 and 75/1200 full duplex and 1200/1200 half duplex, virtually all the popular tele-services can be accessed. A comprehensive Comms ROM oversees the use of the APOLLO, providing simple commands for all the software controlled facilities. APOLLO is an ideal modem for both the first time buyer and the seasoned user. Join the Telecommunications Revolution – Buy a Watford APOLLO!

Only: **£84** **(Carr £3)**
(Write in for full specification)

Minerva Systems Software

System Delta with Card Index	**£55**
System Programmers Ref. Guide	**£19**
System Gamma	**£43**
System Gamma Prog, Ref, Guide	**£19**
System Mailshot	**£17**
System Reporter	**£17**
System Intrer/View Link	**£17**
System Sales Ledger	**£39**
System Purchase Ledger	**£39**
System Nominal Ledger	**£48**
System Stock Management	**£39**
Order Processing/Invoicing	**£39**

Versatile **BEEB SPEECH SYNTHESISER** Unit



The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

SPECIAL PRICE £32 (carr £2)

Continued →

COMPUTER CONCEPT'S ROMS

ACCELERATOR	£48
CARETAKER Basic Utility	£25
DISC DOCTOR	£28
Graphics ROM	£23
TERMI	£25
COMMUNICATOR	£49
SPEECH ROM	£24
Printmaster	£24

Wordwise £24

Wordwise plus

WORDWISE PLUS £40

We are giving away absolutely **FREE,** the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text-segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

HI-WORDWISE-PLUS DISC: £5

SPELL MASTER £47

Inter SHEET ONLY £37

INTER CHART ONLY: £26

Inter-WORD Only: **£39**

INTERBASE £55

All Prices Exclusive of VAT

VIEW

VIEW WORDPROCESSOR 2.1	£35
VIEW 3.0 ROM	**£48**
VIEW PROFESSIONAL	**£79**
HI-VIEW (for use with 6502 2nd Processor)	£36
VIEW Printer Driver Generator Please specify Disc or Cassette)	£9
VIEWSHEET (Acornsoft)	£37
VIEWSTORE	£37
VIEWSPELL with 80 track disc	£29
VIEWPLOT Disc (Please specify for Master 128 or Compact)	£22
VIEW-INDEX	£12
OVERVIEW Packs 1 & 2 for the Master	£75

Watford's own Sophisticated VIEW PRINTER DRIVERS

Epson FX80 & Kaga KP (Disc)	£8
Juki & Brother HR15 (Disc)	£8
Silver Reed Printers (Disc)	£8

Micros in Business (Disc)
An introduction to Business software for the BBC Micro from Acorn **£43**

ADVANCE COMPUTER PRODUCTS' ROMs

Adv. Disc Toolkit	£29
Adv 1770 DFS for Mast/Compact	£29
Adv 1770 DFS for BBC/BBC+	£29
Adv Disc Investigator	£24
Adv. Control Panel	£29
Adv. Rom Manager	£13

MINI OFFICE II

Disc Version	£14.50
ROM Version	£48.00

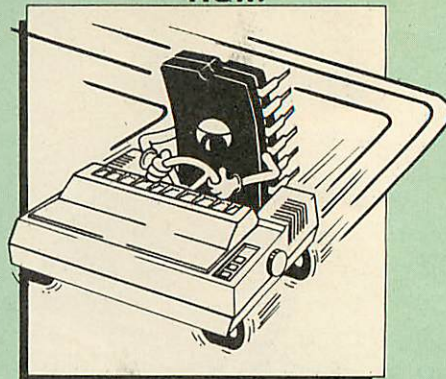
REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£13 (40 or 80 track)

Acorn's Speech Synthesiser package, complete
Special Offer £18

VIEW PRINTER DRIVER ROM



View is a powerful word processor, but until now has seriously lacked in terms of printer support. With the launch of our Printer Driver ROM, which includes an extremely powerful and easy to use Printer Driver Generator, View users can find themselves in the realms of advanced word processing only at a small outlay.

The VPD extends View's printer command with a series of mnemonic commands. All standard highlight sequences are also supported. A large range of printers are supported by drivers contained within the ROM (the drivers can be downloaded and customised). Printers supported include: Epson's MX, RX, FX, FX, LX, JX80 range, HI80, KP810/910, PW1080, JP101, HR15, M1009, GLP, JUKI 6100, etc.

Other printers are readily supported by defining a Printer Driver using the built in Printer Driver Generator. The features mentioned below are available to both the built in Printer Drivers and user defined drivers (assuming the printer supports the features). NLQ control, Underline, Bold, Proportional Spacing, Microspacing, Italic, Superscript, Subscript, Condensed, Enlarged, Double Strike, Set lines per inch numerically (e.g. LPI 6), Set characters per inch numerically (e.g. CPI 5), Select printer font, Select printer ribbon colour, Translation sequences, Emulation of BBC Character Set, Simple numeric expressions for certain operations, Full printer setup, Send control codes, Print prompt on screen, Redefinable Pad character, Pause for key press, Prompt to change daisywheel, and Execute * command when printing.

Other features include a very powerful on screen preview, with bold, italic, underline, super/subscript, enlarged highlights, and a special printer driver to allow memory based text to be previewed by View 1.4. Of course, View 1.4, 2.1 and 3.0 are all supported, as is Shadow RAM and 6502 Second Processors. The BBC B series and Master series of micros are supported. A comprehensive manual is supplied. All in all, a very professional product for the discerning user who wants power at their finger tips. (Write in for a detailed leaflet).

Price: Only £33



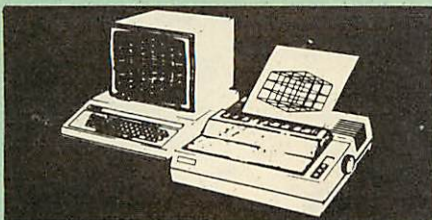
Harness the full potential of your Epson RX or FX printer. The NLQ ROM makes Epson printers produce Near Letter Quality output with optional proportional spacing, enlarged and underlined. Accessed by simple * commands from Basic, Wordwise and View (with driver) or almost any other language.

(Send an SAE for sample printout)

Only: £25

VIEW PRINTER DRIVER for NLQ ROM **£7**

DUMPOUT 3



A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including full Mode 7 graphics.
Also provided are window setting utilities and OSWORD calls to plot and read Mode 7 graphics pixels.
Facilities:

- *Vertical and horizontal scaling in all graphics modes and mode 7*
- *Rotation of image by 90, 180 or 270 degrees*
- *Left hand margin setting*
- *Screen dump window setting*
- *Colours appear as grey scale*
- *Two tone fast dump*
- *Colour mask*
- *Mode 7 contrast expansion*
- *Mode 7 contiguous dump*
- *Key triggered and User Port triggered dumps*

The Micro User Feb. 1985.
'Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC Micro . . . it must represent excellent value for money and surely cannot be beaten".

For use with the following printers:
GLP, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, M1009, NEC PC8023, DMP100/200/400, Panasonic KX1080, Mannesman Tally and compatibles.

Only: £25

(Write in for further details on all above ROMS)

THE EUREKA CARD

(The Unique RAM Expansion System)

The Eureka Card is Watford's latest and most sophisticated RAM expansion system. Using advanced PAL based technology this card is a breakthrough in RAM systems for the BBC micro. The Eureka Card provides the user with around 58K of free memory in Basic, VIEW and WORDWISE PLUS. You also get Shadow RAM from within the active language. No other RAM expansion system can match that!

Load up to 58K long Basic programs. Texts in VIEW and WORDWISE PLUS up to 58K as well. This with absolutely NO loss of speed in accessing your text or program. Eureka consists of a card containing 64K of program memory, two parallel banks of sideways RAM and some extremely complex switching circuitry. This is all controlled by Eureka's highly sofisticated software supplied in ROM. Designed to a very high specification, this board is fully buffered to give reliable operation under virtually any circumstances.

The Eureka board plugs into the 6502 socket and has NO messy flying leads. It is compatible with many other products from Watford, such as our Solderless ROM Board and our ROM/RAM Board. All in all, the Eureka Card is an amazing board. Jump into the age of serious data processing with a Eureka Card! Please write in for further details 'on advantages the Eureka can offer you'.

Introductory price: Only **£89** (carr £3)

(P.S. Eureka is only suitable for a standard model B; it normally replaces any Shadow RAM cards present. Some speed degredation does occur with filing system access. Eureka cannot be used at the same time as a second processor).

BEEBMON

The most powerful machine code monitor for the BBC Micro **£24**.

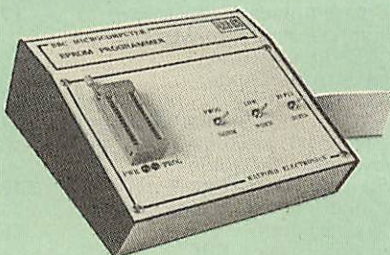
THE NLQ DESIGNER

(The First & still the Best)
Supplied with over 25 Different fonts

A massively useful utility for users of the Taxan/Kaga KP810/910 or the Canon PW1080. This program allows you to define NLQ character sets to download into the printer's memory. Full on screen editing of the font. Requires 6264 RAM chip to be fitted in the printer.
Supplied with disc containing over 25 example fonts. Please specify 40 or 80 track. Fonts are: Italic, Courier, Courier Italic, Script, Copper Plate, Shadow, Bold, Double Print and Gothic etc. (P.S. This ROM is not suitable for Epson printers.)

- *NLQ Designer ROM & FONT Disc* **£25**

ADDER



Adder is the ultimate EPROM programmer for the BBC Micro. It will program many different EPROMs up to the very latest 27256 32K devices.
The Adder unit connects to the User Port and draws its power from there too. The EPROM is mounted in a top quality ZIF socket. There are no switches or controls as Adder is entirely software controlled.
The Adder software provides sophisticated facilities for programming EPROMs from a RAM image produced by loading disc files. The software is menu driven and designed for ease of use.
Features:

- Two ultra fast programming algorithms or standard slow algorithm.
- Supports standard 21V programming and newer 12.5 volt EPROMs. (Software switched).
- The RAM image to be programmed can be built up in many ways. Sections of image can be loaded separately. Part programming. Read EPROM. Edit data in memory.
- Automatic processing to handle a list of files to program into the EPROM.
- Automatic disc buffering to allow programming of 32K 27256 devices from a 32K file without extra effort.
- Verification gives detailed error list and checksums are maintained. There is also a blank check facility.
- Works with all standard filing systems. Generates header code for RFS ROMs to allow Basic programs etc. to be stored in EPROM. More than one file per ROM permitted.
- Programs the following EPROMs: From 2K to 32K: 2516, 2716, 2532, 2732, 2764, 2764A, 27128, 27128A, 27256 (Both 12.5V and 21V).

£65 (£3 Carr)

TEX EPROM ERASERS

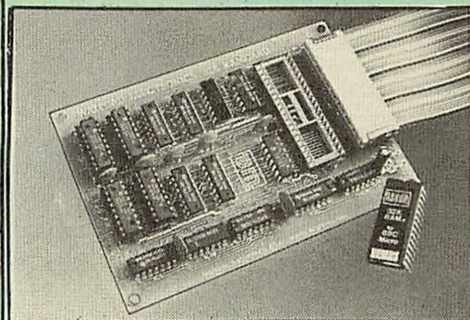
EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£28** (carr £2)
- **ERASER GT** – Deluxe version erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£30** (carr £2)
- Spare UV tubes. **£9**

32K

SHADOW RAM-Printer Buffer

Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B Plus or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory. This product is recommended as an ideal complement by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138,145,ADVAL etc). Please note only a 12K printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.

- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

See next page for SPECIAL OFFER

Only £59 (carr £2)
(Price includes a comprehensive manual and the ROM)

INCREDIBLE WORDPROCESSING DEAL

Watford's 32K SHADOW RAM CARD and Computer Concept's INTERWORD Wordprocessor package.

at Only **£89** (carr £2)

Continued →

BOOKS (No VAT on Books)

15 Hr Wordprocessing BBC/View	£3.95
15 Hr Wordprocessing BBC/WW & WW+	£3.95
30 Hour BASIC (BBC Micro)	£9.95
40 Best machine Code Routines	£7.95
50 Programs in BBC BASIC	£6.95
6502 Assembly Language Program	£19.95
6502 Application	£11.95
6502 Assembly Lang. Subroutines	£19.95
6502 Development Package	£7.50
6502 Reference Guide	£10.95
68000 Assembly Lang. Programming	£19.95
68000 Machine Code Programming	£13.00
68000 Microprocessor Handbook	£14.95
68000 Programming the	£22.95
68000 User Guide	£8.95
6809, Programming the	£16.95
6809 Machine Code Programming	£7.95
8086/8088 Assembly Language Prog.	£11.95
8086/8088 Programming the	£16.95
Advanced Disc User Guide	£16.95
Advanced BASIC ROM User Guide	£9.95
Advanced Programming Guide to BBC	£9.95
Advanced Sideways RAM User Guide	£10
Advanced User Guide for BBC	£10.95
Advanced FORTH	£9.95
Advanced Graphics with BBC	£9.95
Assembly Language Programming on BBC Micro	£11.50
Adventure into BBC BASIC	£6.95
Applied Assembly Lang. for BBC	£9.95
ARM Assem, Lang, Programming	£12.95
Art of Microcomputer Graphics	£14.95
Assembly Language Programming FOR the BBC Micro	£8.95
Basic ROM User Guide	£11.95
BBC B Compendium	£5.95
BBC BASIC for Beginners	£7.95
BBC Forth	£7.50
BBC Hardware Projects	£8.95
BBC Micro & the small Business	£5.75
BBC Micro Advance Programming	£8.95
BBC Micro Basic Sound & Graphics	£7.95
BBC Micro Programming Tips	£8.95
BBC Micro ROM Book	£10.95
BBC Master 128 for High Flyer	£10.95
BBC Micro Disc Companion	£8.95
BBC Software Projects	£6.95
BCPL User Guide	£14
BCPL The Language & its Compiler	£7.95
C for Beginners	£10.95
C for Programmers	£9.95
Complete FORTH	£6.95
Computer Graphics & CAD fundamentals	£9.95
CP-M-86 User's Guide	£19.95
CP-M Bible	£16.50
CP-M Handbook with MPM	£9.95
CP-M Plus Handbook	£13.95
CP-M Soul of	£16.50
CP-M The software BUS	£8.95
Disc Drive Projects for Micros	£5.45
DISC FILING SYSTEM (DFS) Operating Manual for BBC	£6.95
DBASE Programming Language	£14.95
Disc Programming Techniques	£9.95
Exploring FORTH	£6.95
File Handling on BBC Micro	£7.50
FORTH on the BBC Micro	£7.50
Functional Forth for the BBC Micro	£5.95
Guide to BBC ROMs	£9.95
Graphics for Children	£6.95
Hackers Handbook - New	£6.95
Inside Information (Computers, Interfacing & Control o/t BBC Micro	£9.95
Communications & People)	£8.95
Interfacing & Robotics on BBC	£15.95
Introduction to COMAL	£9.50
Introduction to LOGO	£6.95
Introducing 'C'	£9.95
Introducing LOGO	£5.95
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ISO-PASCAL Reference Manual	£9.95
LISP 2nd Edition	£14.95
LISP, A Beginners Guide to	£10.95
LISP on the BBC Micro	£7.95
LISP the Language of Artificial Intelligence	£9.95
Logo on the BBC Micro	£7.50
Logo Programming	£10.95
Mysteries of DISC DRIVES and DFS REVEALED	**£5.95**
Mastering Assembly Code	£8.95
Mastering CP-M	£17.95
Mastering Interpreters & Compilers	£14.95
Mastering Music	£6.95
Mastering View, Viewsheet & Viewstore	£12.95
Master Operating System	£12.95
Mastering the Disc Drive	£7.95
Master Operating System	£12.95
Master Reference Manual Part 1	£14.00
Master Reference Manual Part 2	£14.00
Mastering View, Viewsheet & Basic	£7.95
Micro Prolog	£10.00
Microtext for the BBC	£10.00
MS DOS Quick Referance Guide	£3.95
Practical Disc File Techniques	£5.95
Programming the 6502	£16.95
Programming the Z80	£19.95
Structured Basic	£7.95
The Epson FX-KAGA PRINTER Commands REVEALED	**£5.95**
The Software Business	£5.50
Toolbox 2	£10.95
Towers Int. Transistors Selectors	£12.95
Turtle Graphics on BBC Micro	£7.50
Understanding Interword – A Beginners Guide	£6.50
View 3.0 User Guide	£10
View Guide	£4.50
VIEW incl. ViewSpell & ViewIndex	£12.95
Viewsheet User Guide	£10
Viewstore User Guide	£10
Within the BBC Micro	£13.95
Writing Interactive Interpreters & Compilers	£8.45
Wordprocessing BBC Beginners Guide	£7.95
Wordstar & CP/M made easy	£7.45
Wordwise + A User Guide	£9.95
Z80 Applications	£15.95
Z80 Assembly Language Programming	£19.95
Z80 Reference Guide	£9.95

BBC SOFTWARE'S
Popular Educational Software

- Maths with a Story 1 (Cassette). 4 primary level maths programs **£9.95**
- Maths with a Story 2 (Cassette) 4 further maths programs **£9.95**
- Picture Craft (Disc) 6 - 14 age group. Pack consists of flexible geometrical design & colouring programs **£19.95**
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PCB BY CAD

Drawing up complex circuit boards can be a chore. Computer aided design makes your life easier

Joe Telford

Have you ever looked through those other glossy mags on sale alongside *Acorn User*, the electronics monthlies? Have you ever wondered how Acorn plug all those chips on the green boards inside their computers?

Those green printed circuit boards (PCBs) are glass fibre or resin boards on to which components are soldered to make any electronic circuit, including the BBC micro. There are two sides to each PCB, the component side with the resistors, capacitors and chips and the track side, where the lines on the board are. Normally, the components are mounted by pushing their leads through tiny drilled holes in the board, and then these leads are soldered to the copper lines on the track side to make a circuit.

Some complex boards have lines or tracks on both sides of the board, and the most complex types have more tracks buried inside the board too. The tracks are the 'wires' that join the components together. Obviously the layout of the tracks varies for different electronic circuits, so a new PCB must be designed for every new type of circuit you wish to build. To get round this, some manufacturers have designed special boards like Veroboard. This has lots of parallel tracks at 0.1-inch intervals, and lots of pre-drilled holes along each track. Such boards are quite useful for building prototype circuits, but enthusiasts recommend a specially designed PCB for the most reliable results.

The problem

Many people are put off using printed circuit boards because they appear difficult to make. But the main problem is the actual design of the board and its layout of copper tracks. This is where you can put your BBC micro to good use.

Figure 1 shows you how to produce a PCB. The computer design element is only

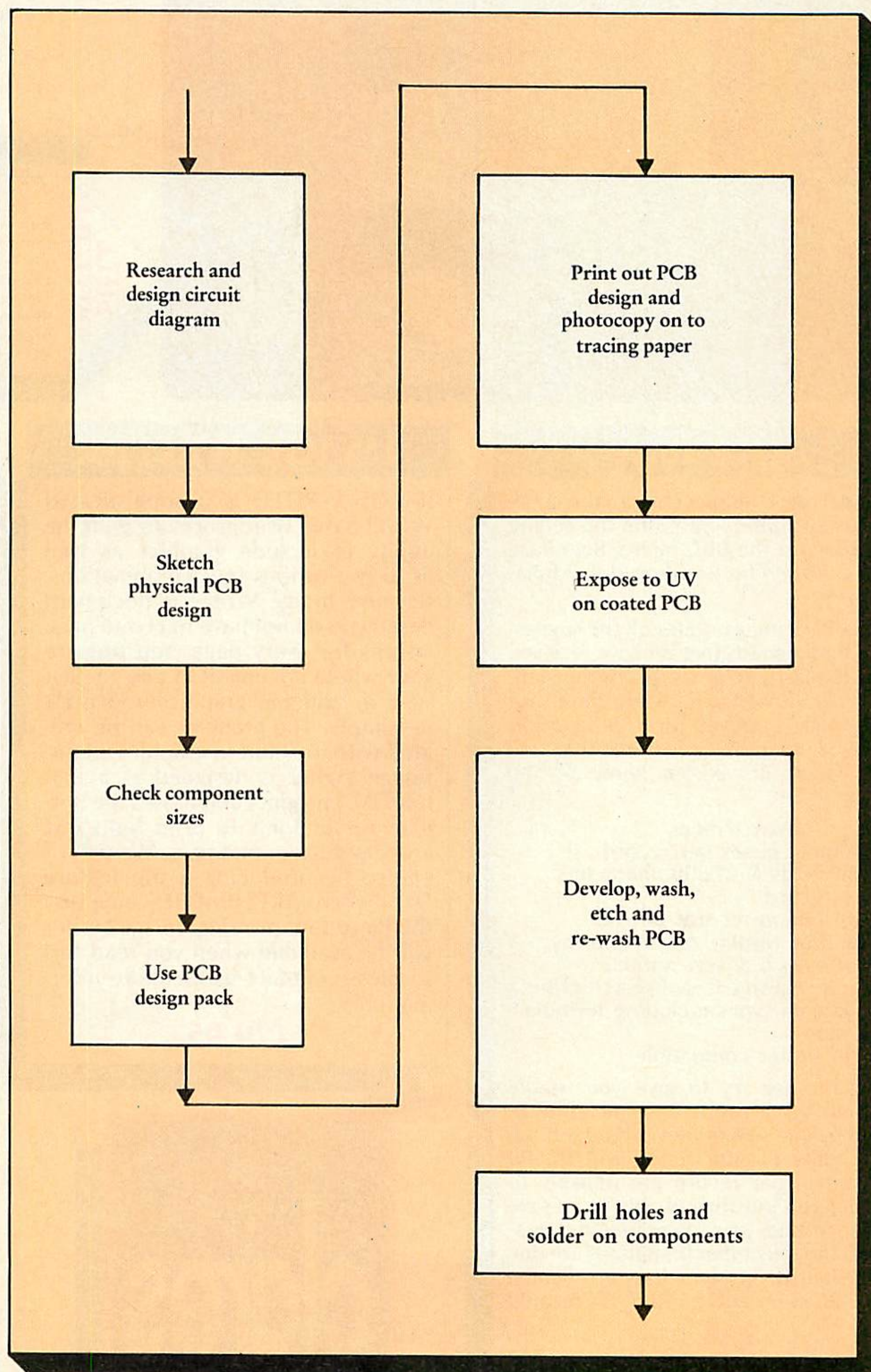
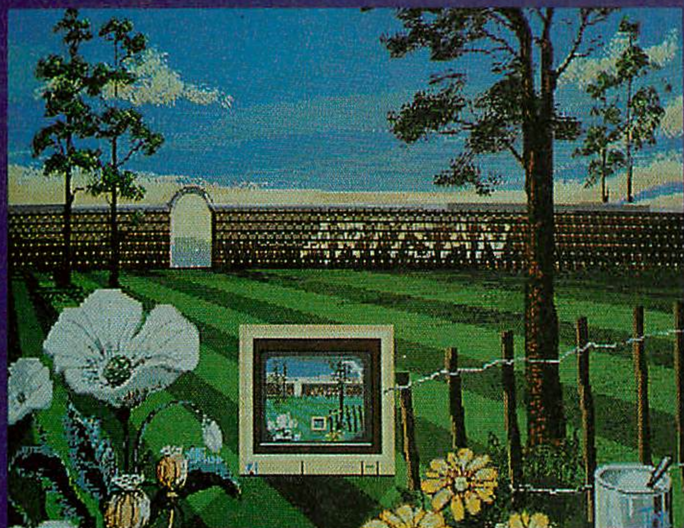


Figure 1. How to produce your printed circuit board

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- Winchester compatible

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one section of the whole process. Let's start by taking a problem and show how a PCB was designed to help solve it.

Beep, beep, beep, beep; the strains of an electronic keyboard hummed through Telford Towers. 'Very good, my dear,' said her ladyship, 'but not quite in time.' My daughter asked, 'Dad, how can I play in time?' Now the average metronome costs two arms and a leg, and so that was out. One alternative was to press the BBC micro into action. I would have used the micro but for the fact that there was every chance my daughter would be learning to play her keyboard for quite some time.

The answer was clear; build a metronome. First, I found a suitable electronic circuit. I decided that she wanted a device that would tick loudly at regular intervals and I soon found a couple of circuits which promised to do that. Cost being ever close to my heart, I soon discovered the 555 timer chip which costs 17 pence in our local high street. The second stage was to alter the circuit to match my needs. This produced the circuit diagram of figure 2.

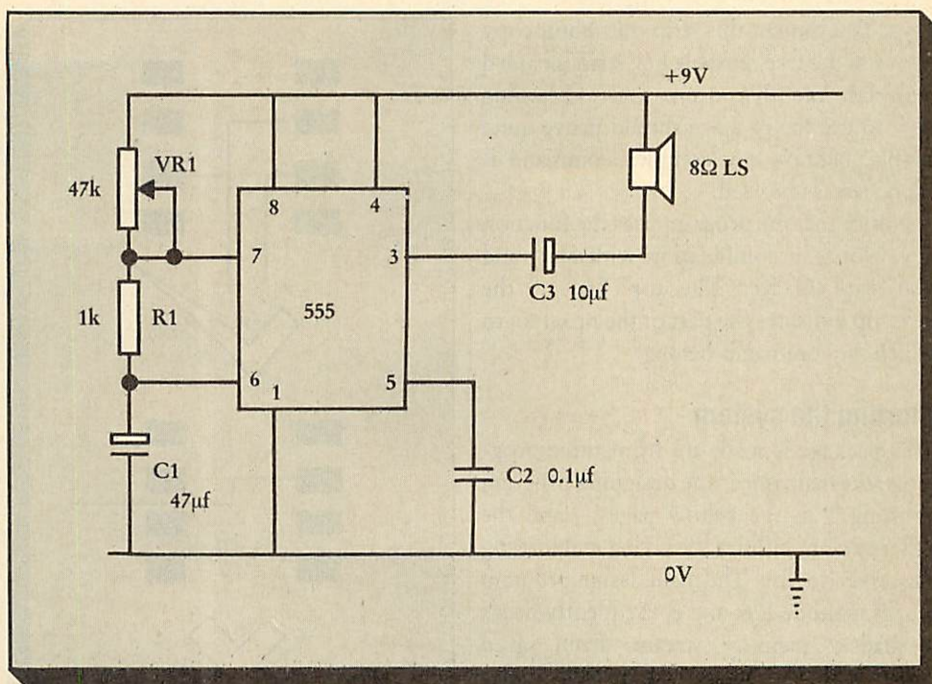


Figure 2. Circuit diagram for the metronome

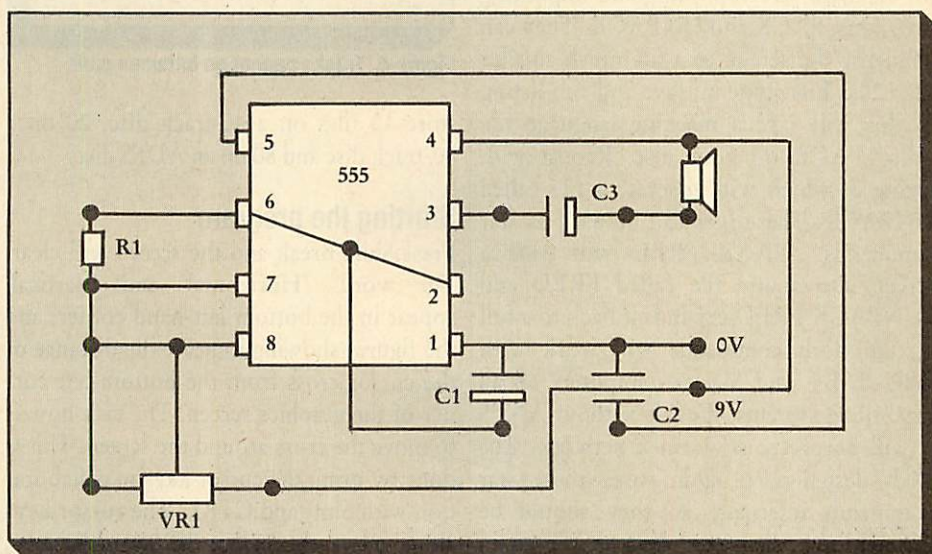


Figure 3. Physical layout of the metronome circuit

Because I believe in reliability and tidy circuitry, I decided to go for a PCB version, and this led to figure 3, which is the circuit diagram in a physical form which closely matches the way that the real PCB components are mounted. I made a list of component sizes and orientations, then set about designing the PCB tracks. This itself was made difficult because designing in indelible felt-tip pen, on copper, in mirror image is not my strong point. It has to be mirror image because all the diagrams show the circuit from the component side – the copper tracks are in reality underneath the board. Now I had another problem – how to make a neat and accurate PCB which could be replicated? It's possible to buy copper-clad boards for PCB production which are covered with a light-sensitive emulsion. Circuit diagrams drawn on tracing paper can be copied on to the board by long exposures to sunlight or shorter exposures (four-and-a-half minutes), to an ultraviolet lamp. This meant that I could design the PCB on drafting film or greaseproof paper the right way round, then reverse it in the exposure stage. I decided to use the BBC Master to develop a design package which would handle most simple PCB computer aided work.

Major specifications

The PCB package specifications included the following:

- Be able to produce PCBs actual size
- Designs should be printed out on printer paper for further manipulation or on tracing paper (using dark ink ribbons)
- Maximum size of board to be designed is 7.5 inches by six inches
- Built-in grids of 0.05, 0.1, 0.5, 0.1, 0.5 and one inch
- Two pad sizes - small (IC size) and large for soldering big components
- Two track widths - thin for ICs and thick for higher currents
- Special preset patterns for eight, 14, 16, 28-pin ICs
- Text use
- Screen manipulations – copy or move areas, reflect horizontally or vertically
- Editing of tracks, pads and areas to correct mistakes.
- Save and load designs to disc.

This package should cope with most day to day PCB design requirements, certainly up to GCSE level in school. However, there are a couple of things which it won't handle. The biggest omission is that tracks cannot travel in between IC pads, although they can travel under ICs, as shown in figure 4. The other omission is in multi-layering. The program will only handle one layer of track at a time. If we needed to produce a board with tracks on both sides, then the approach would have to be to do two separate designs and bring them together outside the computer. Complex requirements like this would usually merit buying one of the specialist PCB design packs from firms like Plotmate or Pineapple.

Figure 8 is the function key strip for the use of this overlay plus a few keyboard

keys. You can cut this strip out, photocopy it, or use the free reusable key strip included with last month's *Acorn User*. Learning how to use the package should prove quite simple, because any complex command is explained as it is used.

Notice that the program uses the function keys alone, in combination with Shift and also with CTRL. The top line of the keystrip indicates the part of the program to which the commands belong.

Starting the system

This package is made up from three programs; the main one is the designing program – listing 1 in the yellow pages – and the other two are utilities for saving and loading the screen to disc. The main design program works in mode 128, and consequently needs a shadow memory stream. Each saved screen would normally take up 20k of disc space. The utility programs are source code for standard screen packing and unpacking programs, PACK and UNPACK. They can condense the screen to a file much smaller than 20k. First type in, save and run listing 2; this will save a machine language file called PACK on your disc. Repeat with listing 3, which will generate a file called UNPACK. These files can be used as star commands. *PACK FRED will pack a screen into a disc file called FRED and *UNPACK FRED expands it back to a full screen. Both commands will work with BBC B, B+ and Master computers on all legal filing systems, though without ANFS it will be pretty slow on a network. The PCB designing program uses these star commands internally so they should be included on the same disc as the main program, listing 1, or in the current library if you are using ADFS or NFS. Use them outside this package too, as they are entirely free-standing. They have much the same function as the LDPIC and SVPIC programmes published in *Acorn User* in October 1986, but now allow the use of the shadow screen as well.

When you have all the programs on disc, you could configure a disc specially for PCB designs. First, format a disc, then copy *PACK/UNPACK and the design program, which we'll call TRACK. Add a !BOOT file as follows:

```
*BUILD !BOOT
0001 MODE 128:CH. "TRACK"
0002
ESCAPE
*OPT4, 3
```

Now the program will operate when you boot the disc using Shift-Break. We can store 10 files on a 40-track disc, 20 on a 80-track disc and 80 on an ADFS disc.

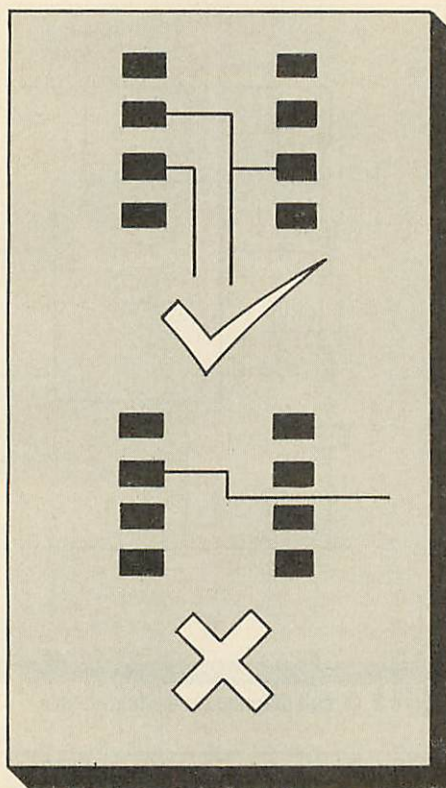


Figure 4. Tracks cannot go between pads

Starting the program

Press Shift-Break and the screen will clear. The words 'Horizontal' and 'Vertical' appear in the bottom left-hand corner, and the figures showing indicate the distance of the cursor cross from the bottom-left corner of the graphics screen. The task now is to move the cross around the screen. This is done by using the cursor keys in collaboration with Shift and CTRL. The cursor keys alone move the cursor in 0.1-inch steps, which match the pin-outs of a wide range of electronic components. For faster movement the Shift key moves the cursor in one-inch increments, and the Shift-CTRL keys together move it in 0.5-inch steps. For extra precision, the CTRL key enables the cursor to move in 0.05-inch gaps.

The main drawing commands to draw tracks are allocated the first three function keys. The easiest to use are f1 and Shift-f1. Function key 1 immediately draws a small pad (about IC size), at the cursor point. Shift-f1 draws a larger pad, which is useful for soldering in bigger components or sockets. Tracks are drawn by pressing either f0 for thin lines or Shift-f0 for thick lines. Just above the horizontal/vertical indicator, is a blank line which the system uses to guide people through the more complex commands. In the case of track drawing, the following sequence is followed:

- Press f0 or Shift-f0
- Message says 'Move to line start and press S'
- Do this
- Prompt then says 'Move to line end and press E'
- Do this; the cursor leaves a 'ghost' line as you move
- Pressing E draws the line as thin or thick as selected

Drawing-in text is a similar multi-stage process. On pressing CTRL-f0, the message 'Type text then press Return' appears. This generates a 'ghost' rectangle on screen, which can be moved around. The message 'press SPACE to fix' indicates how the text can be finalised on screen.

Special drawing commands

Shift-f2 generates a message 'Type code:', and this means type a mnemonic from the following list:

8PINV 8PINH 14PINV 14PINH JOINS
16PINV 16PINH 28PINV 28PINH JOINL

Figure 5 shows most of the shapes generated by each command. The two odd ones are the JOIN commands. These generate tracks, but starting from the current cursor position and hence requiring only an 'E' to fix them. The last 'special' command can be repeated by pressing f2 without the Shift key. Advanced users will quickly appreciate the benefits of using f2 repeatedly with JOINS and then drawing tracks by repeatedly pressing f2. This also automatically

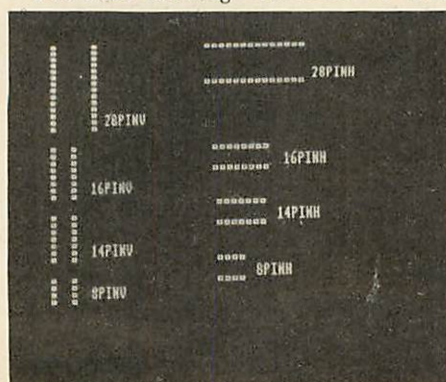


Figure 5. Available chip socket shapes

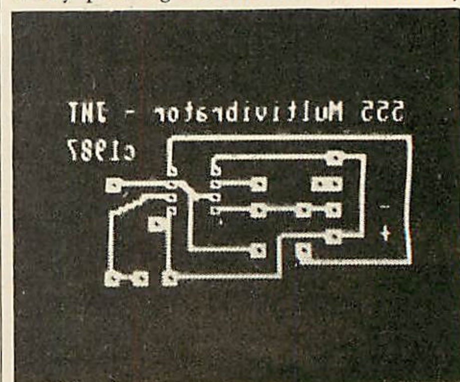


Figure 6. The metronome design on screen

generates the 'E' to end a line then starts a new line. This means a sequence of lines can be drawn with just the cursor keys and f2, then at the very end, a final press on 'E' concludes that track.

The erase commands

Erasing parts of the screen is the only way of editing it. The simplest commands are f4 and Shift-f4, which delete small and large pads respectively. CTRL-f4 gives a warning, then clears the whole screen, effectively giving you a new PCB to use. Both f3 and Shift-f3 behave exactly like f0 and Shift-f0, erasing instead of drawing, though I generally tend to use only Shift-f0, which wipes out thin or thick lines. CTRL-f3 erases a rectangular area of screen, and gives simple instructions for the user to follow in setting up the rectangle.

Screen manipulation is performed by function keys f5 and f6. Function key f5 gives instructions on how to mark a rectangular area, and Shift-f5 lets you move or copy this area to another part of the screen, again accompanied by instructions in the lower area of the screen. Function key f6 marks an area, allows its movement or copying to another part of the screen, and then reflects the rectangle horizontally. For example, text should be inverted to look like mirror writing. This is useful because it means that text on the track side of a PCB can be read once the tracks themselves are inverted during the exposure process. Shift-f6 performs the same task as f6, except that the reflection is in the vertical axis rather than the horizontal.

Both f7 and f8 cause the current screen to be dumped to an Epson-compatible printer. This is done in Basic, and so is slow, but allows the Escape key to be active during the dumping. Again there are prompts at the bottom of the screen. CTRL-f7 displays a catalogue of the current disc. At first sight this is quite worrying, because the PCB design vanishes, but it is in fact saved in a file called 'TEMP', and after the catalogue the PCB design is packed back in. CTRL-f8 allows files to be deleted, so I recommend locking the three main program files. Shift-f7 and Shift-f8 load and save the PCB design to disc. They too are supported by instructions, and the *CAT function can be called from within them.

Remember that the program will not redraw what you delete or cover-up. This means that you should inspect the design for partly deleted pads, or pads without drilling points. This occasionally happens because of the way the program draws and erases tracks. When using the program, remember that Escape will abort almost any action, but it may need a second press to restore the cursor. Filing system errors have not all been trapped, so if you have problems, hunt out DEF PROCerr and add your specific error trapping routines.

Making the board

With the design program complete, I progressed to figure 6 which is the final screen for the metronome PCB. The finished printout is often just a bit too faint to work efficiently, so it can be photocopied onto drafting film or tracing paper to darken it. Next the light-sensitive copper-clad board is placed under the tracing paper, with the printed side of the paper side in contact with the board. They are then exposed to ultra-violet light for four-and-a-half minutes. The exposure is quite critical, and for safety's sake I use a light box which protects users from the ultra-violet rays. There should be instructions available with the circuit board about how long an exposure is necessary, and some types can even be exposed with sunlight.

Next the board can be developed in a bath of caustic soda. This is harmful to the skin, so again take care! After a brief wash, the screen design is now firmly part of the copper board, and you can etch away the spare copper between the tracks using ferric chloride. This too is a poison, so take care. When the copper is etched, the board is washed and dried, then the holes in the pads drilled with a fine 0.8mm drill bit. The components are mounted by pushing their leads through the holes and soldering them into place. Add some power from a nine-volt battery and 'beep, tick, beep, tick, beep, tick...'

I wish I hadn't started, because the next project is the model train set, and the design pack is sufficiently accurate to produce figure 7. When will it all stop?

Details of Joe's listings can be found on the yellow pages index on page 113.

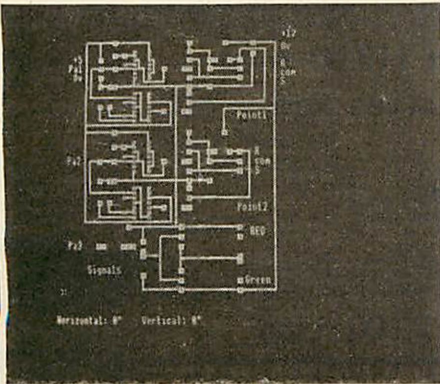


Figure 7. PCB for a train set

	DRAWING COMMANDS			ERASE COMMANDS		MANIPULATION COMMANDS		FILING COMMANDS		EXIT
CTRL	TEXT			WINDOW	WHOLE SCREEN			CAT	DELETE	
SHIFT	THICK LINE	LARGE PAD	SET SPECIAL	THICK LINE	LARGE PAD	COPY/MOVE	VERTICAL REFLECT	LOAD	SAVE	QUIT
	THIN LINE	SMALL PAD	DO SPECIAL	THIN LINE	SMALL PAD	MARK AREA	H'ZONTAL REFLECT	PRINTOUT	PRINTOUT	

Figure 8. Function key strip for the designer

PINEAPPLE SOFTWARE

Programs for the BBC model B, B+, Master and Master Compact with disc drive

DIAGRAM II

Diagram II represents a major breakthrough in the techniques used for drawing software on the BBC micro. It works on a completely different principle to other drawing software by storing the drawing information straight to disc as coded 8*8 pixel blocks.

This technique has three major advantages. First, the size of the diagram is only limited by the amount of space on disc. Second, there is no limit to the amount of information which can be stored on a given diagram as the information is stored on disc and not in computer memory. Third, the disc storage technique allows the smooth scrolling of the screen over the whole surface of the diagram.

For people not familiar with Diagram, the basic operation of the program is to first display any part of the diagram, either by quoting an index name or screen number. At this point you are free to scroll the diagram around the screen using either cursor keys, trackerball or mouse. You may stop scrolling at any point and enter the edit mode which allows you to modify or add new information to the diagram. When you have finished making alterations, the new information is stored to disc and you are free to scroll elsewhere on the diagram stopping to edit at any time.

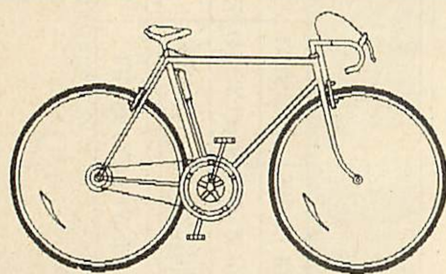
The edit features are now very comprehensive. Text may be typed straight from the keyboard, and if other fonts are stored as user defined characters then these fonts may be printed using the normal keyboard keys.

The print routines are now completely 'scaleable' with both the horizontal and vertical scales being totally variable in 1% steps between a size that will give 18 mode 0 screens on an A4 sheet and a size that would print just one pixel on a sheet! The routines are adaptable to most types of dot matrix printer and full advantage may be made of wide carriage printers. The printouts may be rotated through 90 deg. if required.

The new editing features make DIAGRAM II suitable for all types of serious drawing application including scale drawings, flow charts, architectural, family trees, and many other subjects as well as circuit and schematic diagrams. As an example of what Diagram II can do, this complete advertisement (with the exception of the PCB drawing) has been produced with the package.

SUMMARY of DIAGRAM II FEATURES

1. Works on any model BBC computer with either DFS or ADFS.(ADFS only if Shadow memory available).
2. Will automatically take advantage of shadow memory (any make) to provide more User Definable Characters, 880 with Shadow, 381 without Shadow.
3. Rapid horizontal and vertical line drawing routine with automatic joins for circuit diagrams.
4. Full rubber band line drawing and circle drawing modes.
5. Takes advantage of the Acorn GXR rom to provide drawing of arcs, sectors, chords, parallelograms, ellipses, and flood filling. Note this rom is already fitted to Master and Compact machines.
6. Pixel cursor drawing and deleting mode allows very fine detail to be added.
7. Defined areas of screen may be moved, copied, deleted or saved to disc.
8. On-screen indication of cursor position shows either the cursor position on the overall diagram or the distance from a preset point.
9. Keyboard keys may be predefined to print User Defined Characters, enabling new character sets to be stored as user defined characters and then printed straight to the screen using the keyboard keys.
10. Wordprocessor files may be loaded to the screen and automatically formatted into any shape screen area.
11. Index names may be set up to point to given areas of a large diagram, to enable rapid access to a given point on a diagram.
12. Fully compatible with Marconi trackerball and most makes of mouse.
13. All Diagram 'Utilities' are included, enabling screen ident numbers and borders to be added, and any area of diagram to be moved or copied. The whole diagram may be displayed in reduced scale (either 4*4 or 8*8 format) on a single screen, and the size of the overall diagram may be increased or decreased.
14. Completely scaleable print routines allow any area of the diagram to be printed either horizontally or through 90 deg. in scales that may be varied in 1% steps allowing up to 18 mode 0 screens to be printed on an A4 sheet (still with readable text).
15. Complete with 40 page easy to understand handbook.



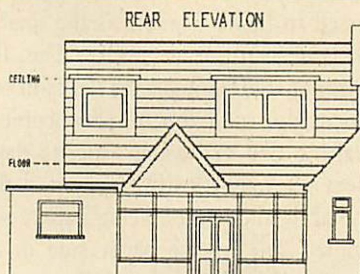


Diagram II consists of a set of disc files and a 16k Eprom. The disc supplied is formatted in 40T on side 0 and 80T on side 2. Please state if this is unsuitable for your system, or if you require a 3.5" Master Compact disc.

DIAGRAM II – £55.00 + vat

P & P free (except overseas)

N.B. Upgrades are available to existing Diagram owners. Please contact Pineapple if you have not received an upgrade letter.

PCB

Pineapple's now famous printed circuit board draughting aid produces complex double sided PCB's very rapidly using any model BBC micro and any FX compatible dot-matrix printer.

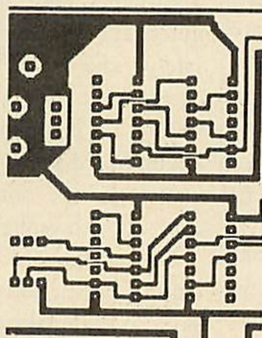
The program is supplied on Eprom and up to 500 component and 500 ASCII component descriptions may be stored for each PCB. There is no limit to the number of tracks that may be stored for a given PCB although the maximum board size is restricted to 8" * 5.6".

Using a mode 1 screen, tracks on the top side of the board are shown in red, while those on the underside are blue. Each side of the board may be shown individually or superimposed. A component placement screen allows component outlines to be drawn for silk screen purposes and component numbers and outlines entered on this screen may be displayed during track routing to aid identification of roundels.

The print routines allow separate printouts of each side of the PCB in a very accurate expanded definition 1:1 or 2:1 scale enabling direct contact printing to be used on resist covered copper clad board. The print routines are very fast taking typically 5 minutes for a 1:1 print of a 7" * 5" board.

This program has too many superb features to describe adequately here, so please write or 'phone for more information and sample printouts.

PRICE £85.00 + vat



PCB PLOTTER DRIVER

A new addition to the PCB software is the PCB plotter driver program. This enables files produced by PCB to be used in conjunction with most types of plotter to produce plotted output rather than the normal dot-matrix printer output.

In this way plots may be produced directly onto film or even directly onto copper board with an etch resistant pen if a suitable plotter is available. The program is suitable for use with most makes of plotter including Hewlett Packard, Hitachi and Plotmate M. The program can also be configured to work with other plotters by entering suitable plotter instructions.

All the features of the printer driver are included, such as the automatic thinning down of tracks between roundels. Mirror image plots are also available.

PRICE £35.00 + vat

MARCONI TRACKERBALL

This high quality device comes in three versions. Version one is for the standard BBC micro and comes with the Icon Artmaster drawing package from Micro-Draw, and Trackerball Utilities which allow the trackerball to be used with other software.

Version two is for the Master 128 computer and this comes with the Pointer Rom. This is a Rom which allows the Master to be configured for use with the Trackerball and has commands to enable the Trackerball to intercept the cursor key or joystick routines of other software. Commands are also available to reverse the axes of the trackerball and set the sensitivity. The three buttons may also be set up to produce any ASCII code.

Version three is simply the bare Trackerball which comes without software but is suitable for use with specially written software such as Diagram or Diagram II.

Trackerball adapters are also available which plug onto the end of the cable and convert the connections of the trackerball to be the same as a mouse. This enables the trackerball to drive all types of 'mouse' software.

For Model 'B' and B+ (with Icon Artmaster)	£ 60.00 + vat
For Master 128 (with Pointer Rom)	£ 60.00 + vat
Bare Trackerball (no software)	£ 49.00 + vat
Pointer Rom - available separately	£ 12.50 + vat
Trackerball to mouse adapters	£ 8.00 + vat
Postage & packing on Trackerballs	£ 1.75

MITEYSPICE

Miteyspice is a very powerful AC & DC circuit analysis package with graphics suitable for use with any model BBC micro including those with 2nd processors.

As well as all the usual facilities available with this type of program, non-linear effects, small signal, noise measurements and sweeps may be performed. Component values may be swept, allowing component tolerances to be investigated as well as thermal performance etc. Comprehensive transistor modelling is incorporated using a 20 parameter Ebers Moll description. The program is supplied on disc with a very comprehensive 49 page manual.

PRICE £119.00 + vat

ADFS Utilities Rom – ADU

ADU is an invaluable utility for all ADFS users. It adds over 20 new *commands to the ADFS filing system as well as providing an extensive Menu facility with over 35 sub commands covering areas such as repeated disc compaction, saving and loading Rom images, auto booting of files and many more.

Copying of DFS discs onto ADFS discs can be made in one pass with automatic creation of the required directories on the ADFS disc. All functions are fully compatible with Winchester drives including *BACKUP which allows backing up of Winchesters onto multiple floppies.

Additional *commands include:- *ADU, *BACKUP, *CATALL, *CHANGE, *DFSDFS, *DIRALL, *DIRCOPY, *DIRDESTROY, *DIRRENAME, *DISCEDIT, *DRIVE, *FILEFIND, *FORMAT, *KILLADU, *LOCK, *MENU, *PURGE, *PWRBRK, *UNLOCK, *VERIFY, *VFORMAT.

PRICE £29.00 + vat

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Access

THE NEW AMX MK. III MOUSE. TRAP ONE SOON.

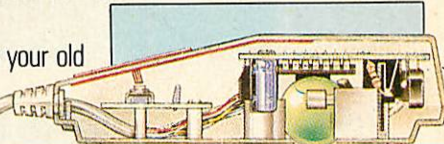


The MK III AMX Mouse is a product of Swiss precision and the result of a world-wide search to find a worthy successor to the AMX Mouse MK II.

The new Mouse has been specifically chosen to be the perfect partner to the ever expanding range of AMX software. The unique patented design includes high resolution D.P.I. and superior ball technology to ensure that contact between the Mouse and the surface is constant at all times.

There's a new shape too, that fits comfortably in the hand.

The AMX Mouse MK III costs only £34.99 or you can join the great "Mouse-Swap". Part exchange your old Mouse for the MK III for only £29.99.



*SUPERART

AMX MOUSE MK III PLUS SUPERART 16K ROM, PLUS DISC £79.99

Acknowledged as the most sophisticated, yet easy to use paint package available for the BBC Micro, it's no wonder over 20,000 have already been sold.

'Superart' features include cut, copy, paste, move, rotate, plus many, many more such as fantastic spray and zoom facilities.

Available for BBC B, B+; Master 128, and Master Compact. Please state which version is required when ordering.

SUPERART (ONLY) £49.99

PICTURE GALLERY 2 × FLIPPY DISC £24.99

Instant art! A collection of fine drawings produced by acclaimed artists using superart.

*STOP PRESS

AMX MOUSE PLUS STOP PRESS 2×16K ROM, 2×DISC £79.99

The most highly acclaimed desktop publishing software available for the BBC Micro. Already thousands of users are producing professional documents, newsletters, flyposters etc. in fact anything where text and graphics are required.

'Stop Press' comes complete with 16 variable typefaces.

Available for the BBC, B+ and Master 128. Please state which version is required when ordering.

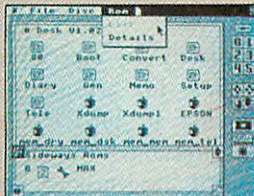
STOP PRESS (ONLY) £49.99

EXTRA! EXTRA! 2 × FLIPPY DISC £24.99

300K fantastic clip art, over 25 fonts and utility software.

*MAX 16K ROM £19.99

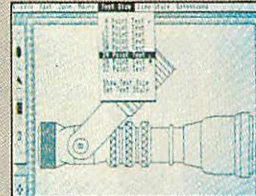
MAX provides an easy to use graphic based front end to your computer's disc filing system including a comprehensive set of disc management operations such as cataloging, copying, deleting and re-naming. You can also run programs from within MAX. Available for the BBC, B+, Master 128 and Master Compact. Please state which version is required.



*AMX DESIGN 32K ROM AND DISC £69.99

A highly sophisticated CAD package which allows the user drawings to be produced such as a simple PCB design up to the most intricate, architectural drawing.

Advanced features include full zoom and macro facilities, 58×58 screen canvas, full supported printer and plotter output. Available for the BBC, B+, Master 128 and Master Compact.



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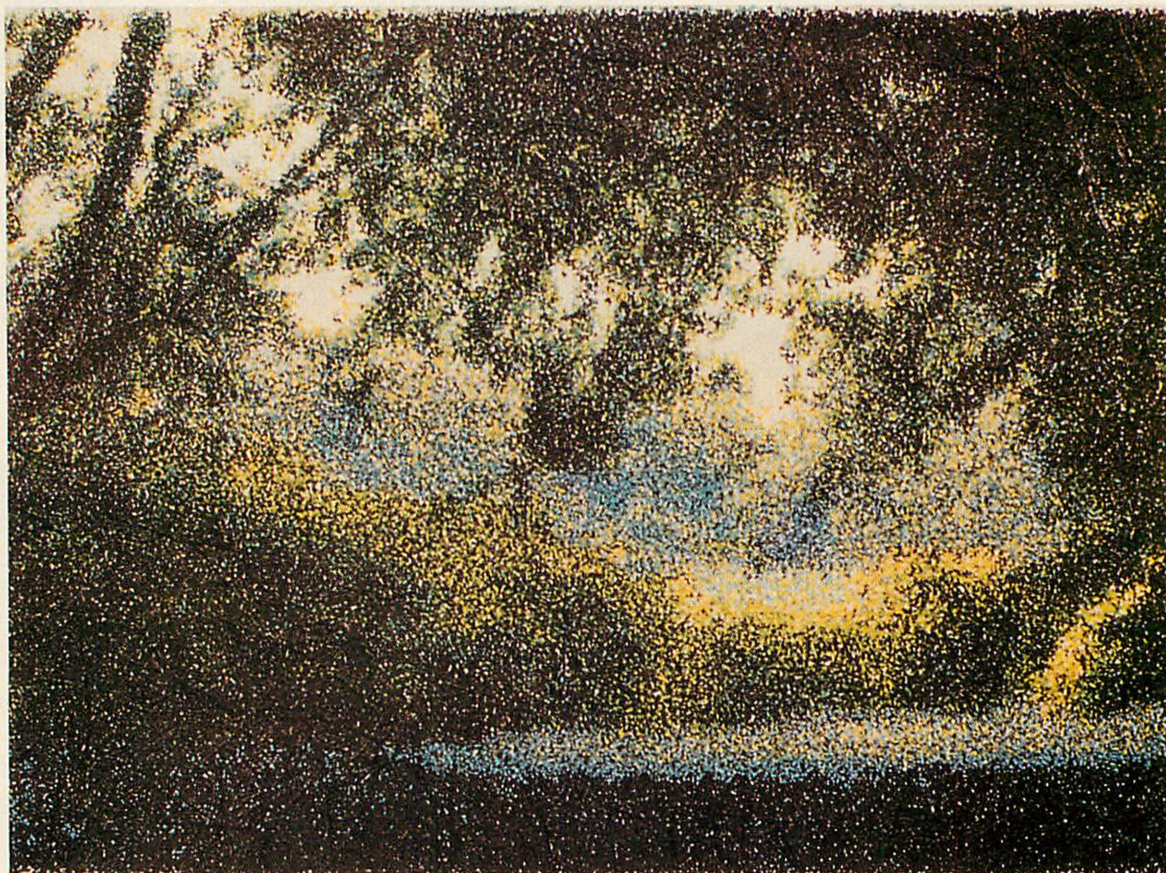
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TUBELINK ON PRESTEL PAGE 2582182 SUPPORTS THE AMX MOUSE, AND ALL AMS SOFTWARE.



PRETTY AS A PICTURE

Computer artist Karl Torok has found stunning graphics are possible if you turn the technology to your advantage

Brian Larkman

We all know what computer art is – we see it every time we watch the television. Yet the computer art that we have come to take for granted is only one aspect of a subject that is as old as computers themselves.

Computer art is separate from computer graphics in the same way that fine art painting is separate from graphic design or illustration; both disciplines use many of the same techniques but 'art' somehow carries the impression of loftier ideals and less interest in the commercial market. As in other areas of life, absolutely any aspect of computing is fair game for artisitic interpretation, but computer art broadly falls into the two main directions - high tech versions of traditional imagemaking and art generated by a program written by the artist.

Painting With Light, a recent series of television programmes, illustrated the high tech approach, providing six established artists with Quantel Paintbox systems for a day. The results showed how a very powerful computer system used in an artistic context could produce conventional results almost indistinguishable from traditional, 'hand-crafted' art-works. In fact the series was rather disappointing as the artists involved seemed to be reluctant to experiment with the remarkable facilities that Quantel provides. Much more interesting is the work of artists like Mike Marshall, Margot Lovejoy, Alyce Kaprow and others working at MIT and other American institutes with access to powerful paintbox systems. Their work is impossible using conventional techniques.

At the other financial extreme is the work of artists like Karl Torok who use

ILLUSTRATIONS BY KARL TOROK



cheap home micros like the BBC, Atari ST or Amiga with relatively simple 'paintbox' packages like *Artist* (on the BBC), or *Deluxe Paint* (on the Amiga) – simple compared to the Quantel. These can produce many of the effects of the expensive systems but suffer from the limited range of output available. One of the main criticisms of this type of artwork, whether on cheap or expensive systems, is that the software and hardware constrains the artist to some extent, dictating the style of the end product. However the limitations of the micro can be turned to benefit with a little thought.

Take a look at the pictures by Karl Torok on these pages. Until a couple of years ago he was producing drawings and paintings very similar to these by hand. Working from old photographs and postcards, the picture was built up on the canvas with thousands of dots or dabs of a small range of colours – an incredibly laborious technique known in artistic terms as pointillism. Viewed from a normal distance, the dots merge and blend to create the whole range of hues, similar to the way a complete TV picture is built from only red, green and blue dots. Painting a single pointillist picture by hand could take weeks or even months.

Inspired by a computer linked to a digitiser glimpsed in a shop window, Torok set up his own computer assistant – a BBC micro, an R H Electronics digitiser, and a dot-matrix printer. This seemed a reasonable start.

After all, a computer screen is also made up of many dots or pixels, and because there are only eight colours, you are often forced to use mixes or 'dithered' colours to produce a reasonable range of hues. A dot-matrix printer provides a sort of mechanical pointillism. But after using one for some time its artistic limitations became increasingly apparent to Karl.

A range of techniques are available for the computer artist to produce screen images. These include simple paintbox systems (like those described by Paul Bayley in this issue), more complex painting hardware, such as that by Quantel, digitising or frame-grabbing and programmed imagery. This can be carefully designed, as with TV station identification trailers for example, or art generated by the computer with random elements, a style used by the Micro-Arts group. All of these systems are fine if the screen display is the final destination for the image – some artists even value its temporary nature. But for most people, the computer is just a means of developing and manipulating an image. The



final product has to be on video, film or most likely paper – and it is here that the real problems begin.

Video is in some ways the ideal medium to record computer art: it is cheap, widely available and easy to show now that so many people have access to VCRs. It allows still or moving images, in colour. However, the image quality is usually poor and editing is very difficult without expensive equipment. Many home micros do not allow for video recording, though it is possible with the BBC micros.

Film is usually too expensive to use as a storage medium. It is possible to take both moving and still photographs direct from the monitor screen, but problems with scan-lines, and especially with distortion due to the curve of the monitor glass, make film images very unsatisfactory. Systems do exist to photograph screens directly, the Polaroid Palette for example, or by a direct output to a higher quality transparency-maker, but these are extremely expensive.

The only realistically cheap method is onto paper, using a dot-matrix, ink-jet, or laser printer – or a plotter. As Torok found, even the versatility of a dot-matrix printer does not always produce an artistically acceptable image. This type of printer builds up its image with a series of dots on a matrix or grid. Any image printed by this method naturally takes on an orderly, mechanical appearance. It can be softened by overprinting several times but can never be entirely overcome. Another severe limitation of dot-matrix and thermal printers is the usually very evident horizontal bands of overprinting that they produce as a by-product of the way the printhead moves backward and forward across the paper. This can be overcome to some extent with an ink-jet printer, but the regular pattern of the dots is still evident.

A laser printer is the 'ultimate' output device, as it has very high resolution and also overcomes the horizontal striped look. But other problems become apparent, particularly cost, which often puts it out of reach. In any case, a laser printer can only print whatever graphic image is on the screen dot for dot. The high resolution of the printer is wasted as the image is still limited by the resolution of the screen.

The only other common form of computer-generated hard copy is drawn by a plotter. At first sight this seems the least likely way to produce an artistic image. Nevertheless, this is what Karl Torok uses.

John Downie wrote the software that Torok now uses. His first contact with Karl Torok, an established artist and printmaker, was about some computer aided



design software that Downie had been writing – but it was clear at once that it was unsuitable for Torok's purposes. He wanted plotter driving software to dump computer screen images. Downie explained that a dot-matrix printer rather than a plotter was normally used to do this, but Torok understood the difference and he wanted to drive a plotter.

Downie realised a plotter could do the job, drawing a dot of the appropriate colour for each screen pixel and moving the plotter accordingly. Such an approach would be possible, but surely out of the question since it would take hours to dump a single screen. The lines and areas of a screen drawing can't be drawn by the plotter, unless the picture was drawn with a computer painting package. Karl, however, was delighted at the prospect of such relatively rapid work, since his pointillist technique normally required months of painstaking dotting with drawing pens.

A simple program was quickly written for an A4 plotter and a version of this is on the yellow pages. To avoid the uniformity and unwanted structure that appears while working from the screen, an early addition to the basic program was to use small random but controllable variations in the position of the pen. Control over the density of the plotting was also provided. These early programs were used to produce a series of pictures that rapidly showed the power of such an approach.

Karl began to produce some quite stunning pictures from the software. He uses digitised video images from photographic transparencies and builds up the required scene by combining several versions of the same photograph, using different graphic modes, and sometimes different optical filters on the video camera. The programs combine colours and allow small areas of the image to be developed and edited.

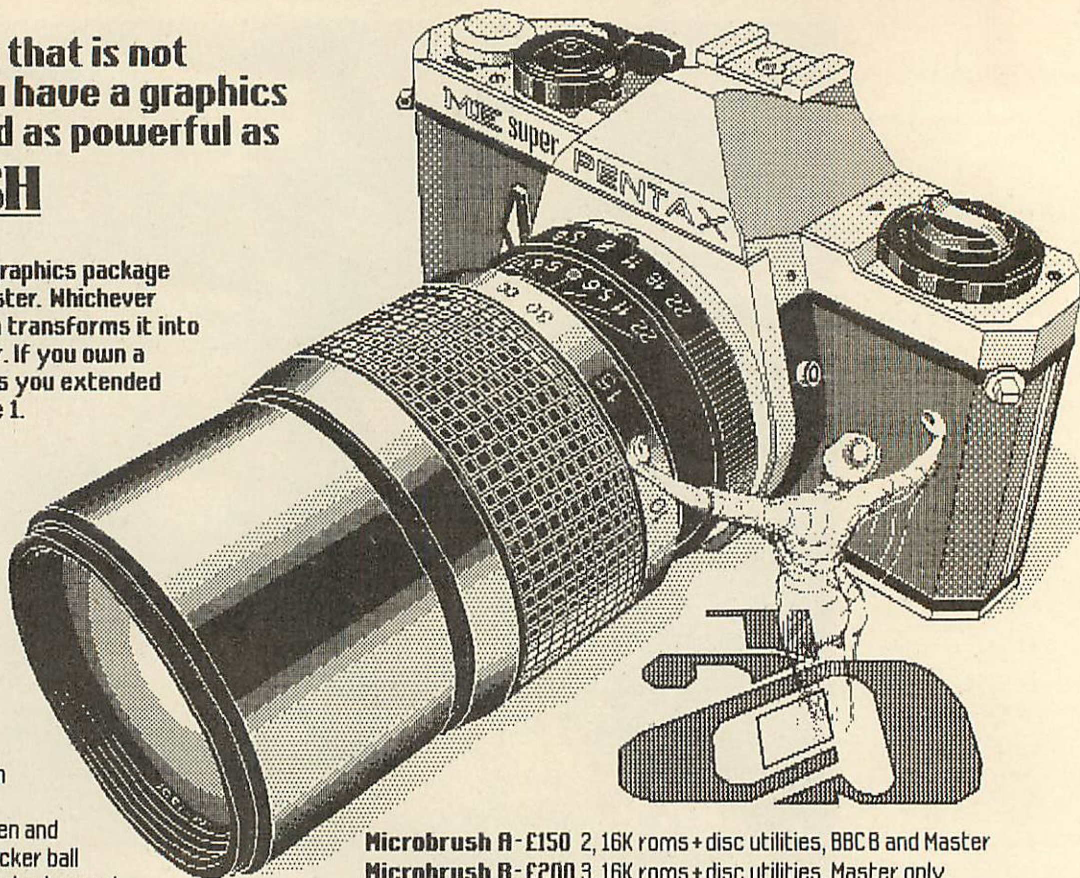
The program allows control over the shape that the pen draws at each point. Squares, loops, hatch lines, triangles and waves were experimented with, with random position, size and orientation introduced. Mathematical distortions of the original screens were easy, algorithms were developed which made a good attempt at causing the pen to follow lines smoothly.

Karl, however, has explored very few of these novelties, concentrating his efforts into developing themes based on the original methods. He has gained a superb control over the use of the software, and by slecting densities, randomness, inks, pigments, pens, and paper textures his pictures have grown from simple screen dumps to fine works of art.

Could you produce this advertisement on your Micro?

There is very little that is not possible when you have a graphics system as fast and as powerful as

MICROBRUSH



Microbrush is a professional graphics package for either the BBC B or the Master. Whichever machine you have, Microbrush transforms it into a powerful graphics computer. If you own a Master then Microbrush offers you extended resolution in mode 0 and mode 1.

Mode 0 - 1216*416

Mode 1 - 608*416

This whole A4 page was composed as one mode 0 high resolution image using the out-board scroll system, and has a resolution of 1216*900 pixels.

Microbrush for the BBC B is comprised of two 16K roms. The Master version contains a third rom. The first two roms can be used in either machine.

The whole system is menu driven and controlled by the Marconi RB2 tracker ball for speed and precision, but may also be used with either the AMX or the Whigmore mouse. Please note that the tracker ball is not included.

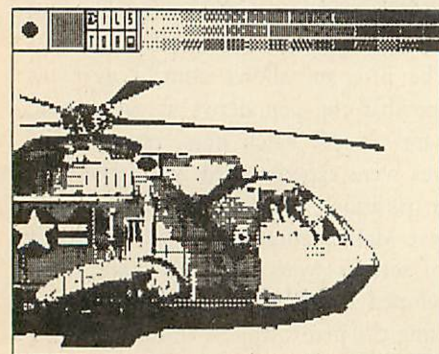
Microbrush A-£150 2, 16K roms+disc utilities, BBC B and Master

Microbrush B-£200 3, 16K roms+disc utilities, Master only.

When ordering please remember to state which system you require, whether you need 40 or 80 track discs and a telephone no. if you have one. Orders and information requests should be sent to-AB Designs, 81 Sutton Common Road, Sutton, Surrey. Phone 01 644 6643

The Painting system

This is just 1 of 33 major graphic systems contained within Microbrush and offers you 42 colours in mode 1 and 42 grey tones in mode 0. New colour palettes can be created with which you can draw lines, sketch, fill, paint in foreground, background, opaque, transparent and combined colour. Add this to a colour rubber which will selectively erase any actual colour and you have a very powerful painting system with more than **1,000,000** possible colours.



Above the painting system in mode 0.

The Ikon Generator

The ikon generator is the main workhorse of the Microbrush system as it is used for both generating and positioning any ikon up to 6*3 character blocks. This system is also used by the typesetter and for creating colour palettes, rubbers, paint-brushes and typefaces. Up to 46 ikons can be stored in memory. The scope of the ikon facility is immense as it allows you to transform the Microbrush system into a purpose built design tool that suits your needs.

The Type Setter

With the Microbrush system you will receive 50 proportionally spaced typefaces. The smallest allows you up to 170 characters to the line and if this is not enough then you can design your own typefaces.

The typesetter displays the current font as a scrollable menu allowing you to quickly produce professional typography.

The Screen Editor and the Special Effects Generator

The screen editor is a powerful drag system that allows you to store up to a quarter of the screen in memory. Once stored, images can literally be dragged across the screen, repeated, copied, saved to disc or fed to the special effects generator.

The Special Effects Generator

This is a very versatile system which will automatically outline, inline, shadow, 3D, half-tone, etc. any image held within the screen editor's memory.

The Injector rom

The Injector rom is the second rom in the Microbrush system. This rom contains the drawing functions such as lines, rectangles, circles, ellipses, arcs, rotate, squash, stretch, zoom, halve and quarter screens, plus a whole host of other functions.

This is a very brief description of just 7 of the 33 graphics systems contained within Microbrush. All of the systems are both fast and easy to access. Microbrush also includes a 7*7 character pixel editor and an Epson FX80 screen dump.

The Master rom

The Master rom takes you into a completely different world of graphics with almost 4 times the resolution in modes 1 and 0, plus 2 on-board graphics screens, 10 rom based typefaces and a 3D generator which is linked to a 10 point perspective system. This allows you to deal with exceptionally complex perspective tasks such as the camera seen above. Also available for the Master rom is an out-board scroll system which allows you to build images with a resolution greater than 1216*2000, plus there are high res. screen dumps for both Epson and Integrex printers.

Lastly flick through the pages of this magazine and see how many of the other graphic systems are capable of producing their own advertising.

Extentions to the Microbrush system include - The out-board scroll system-£40, an extended Master rom offering you 14 colours in mode 1 and 4 colours in mode 0 -£85, a typeface editor plus fifteen extra typefaces -£25, the Master rom -£65. No VAT if purchased before September 1.

DRAWING THE CROWDS

How do you produce graphics good enough to sell? A professional computer artist gives away some trade secrets

Jonathan Inglis

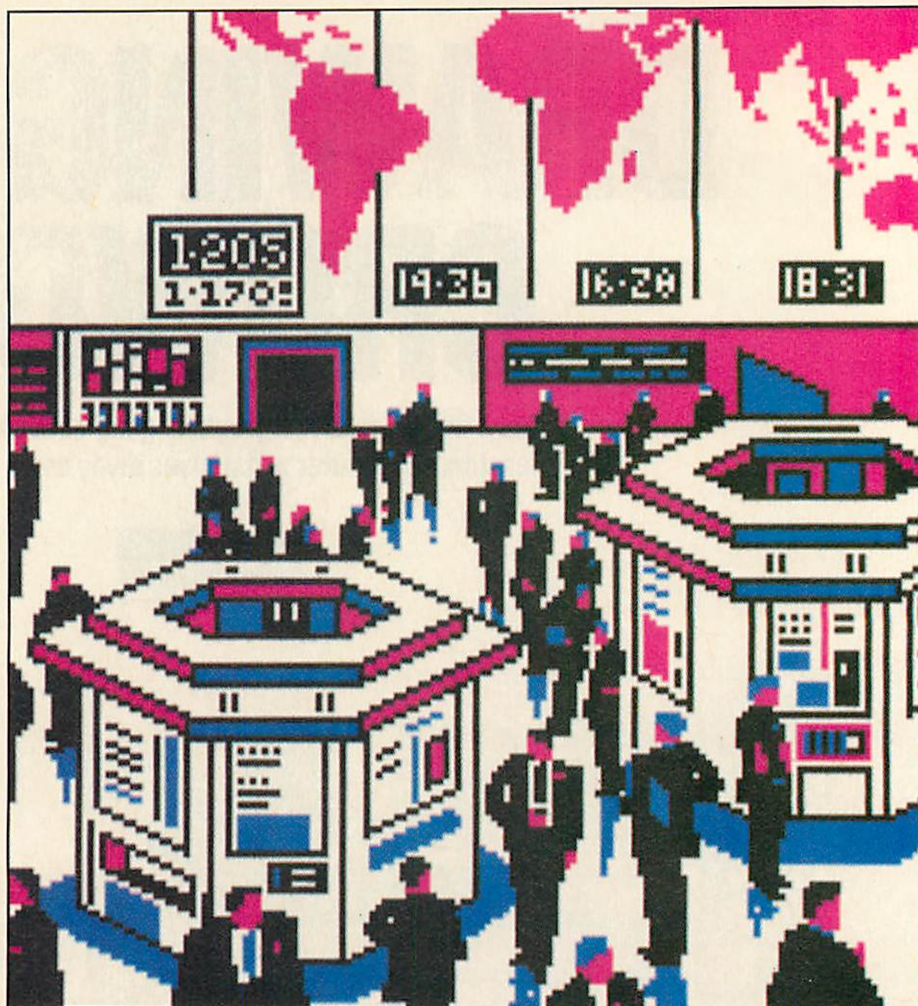


ILLUSTRATIONS BY JONATHAN INGLIS

As a former art teacher, my background is in painting rather than computing. I became fascinated by the artistic possibilities of the computer, and soon became convinced that it could be used as a legitimate artistic medium. The more people who said it couldn't be done, the more determined I became. Since leaving teaching, and becoming a full-time freelance illustrator, my work has appeared in a number of magazines – the *Sunday Times* and *Observer* colour magazines, *Radio Times* and of course on the cover of *Acorn User*. This work, plus commercial advertising and promotional material, has until recently all been done on a BBC micro.

Despite the advances of the past few years, many people in the art and design field are still surprisingly unwilling to accept computers and computer graphics. New technology in the print and broadcast media is creating a demand for new skills and jobs, for which there is a shortage of

The Stock Market scene (right) shows how a bold use of unrealistic colour can produce a striking effect. 'Still Life' (far right) illustrates drawing with simple geometric shapes – straight lines and ellipses. Notice how white lines on a dark background give the glass a transparent appearance, while the white highlights on the apple give the impression of three-dimensionality



suitable applicants in many cases. Education authorities and the Government should recognise the importance of computers in art and design, and act accordingly.

Five years ago, it was far from easy to convince others that the BBC micro could be used creatively. Early art packages were designed around the limitations of the model A and took ages to load from cassette. You could draw low resolution circles, triangles and diagonal lines, but the instructions were often confusing or misleading. Make a mistake and you probably had to clear the screen and start again. Most people retreated to the safety of pencil and crayon. It was a bad start from which the industry is still recovering.

For the persistent there were soon rewards, in particular the Grafpad and Computer Concepts' *Graphics* ROM. Programs began to appear in magazines making it possible to begin compiling a collection of useful graphics utilities. The original AMX *Art* did much to promote user-friendly graphics on the BBC micro, and it is still an excellent package for the beginner. The AMX utilities included the earliest pixel editor that I used. The release of *Super Art* and *Pagemaker* (now *Stop Press*) in the same year established a good standard of graphics software design and documentation, and this has been consolidated since. The release of Watford's excellent *Quest Paint* package, seemingly the most comprehensive drawing package yet, has enlivened what has been a somewhat quiet patch recently.

The studio

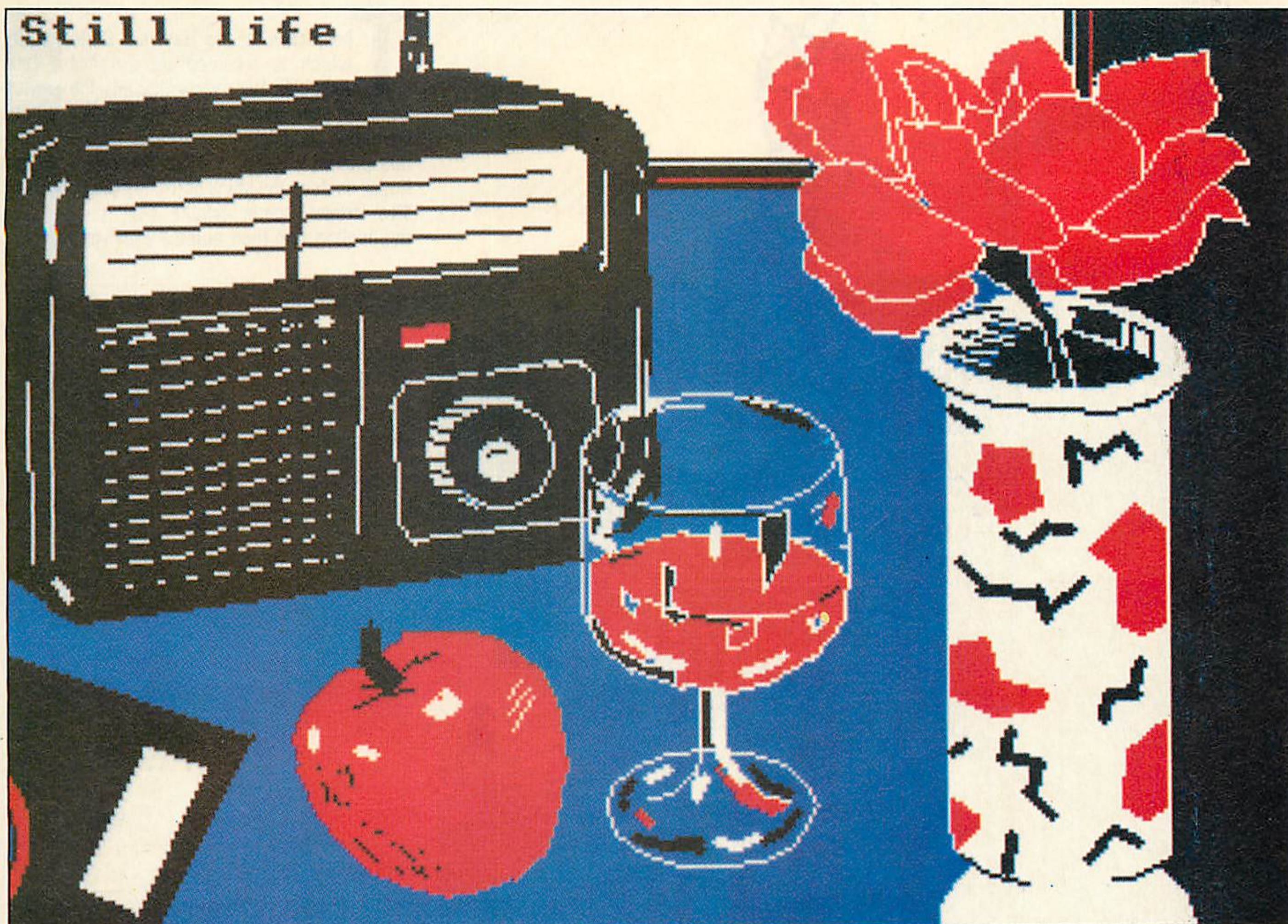
My 'studio' consists of a standard BBC micro with a Sidewise ROM board, Microvitec colour monitor, disc drives and mice, a Grafpad, Watford digitiser and an Epson RX-80 printer.

For simple outline work, it is sometimes easiest to use keyboard-based programs such as Rob Fenton's *Paintbox* which allows for accurate positioning. I don't like joysticks or light pens as they are less precise. Using a mouse is the most natural way to draw; it's even preferable to using a graphics tablet. The Nidd Valley mouse was recently reviewed in *Acorn User* and criticised for its slightly 'heavy' response, but it is this that makes it ideal for drawing freehand. It helps to have a slightly slower cursor movement.

A digitiser is well worth having too, if you can afford it. It's fascinating just to watch the night's television slowly unrolling on your monitor, and grabbing the 'bones' of a picture, to be cleaned up later with normal art software. The Plotmate Scanner is a device which fits on a plotter and scans black and white artwork, storing the resulting image as a standard screen. It requires a certain amount of practice, as not all pictures will give good results, and it's expensive, but schools with a plotter of their own might like to investigate.

As far as software goes I don't use one package to the exclusion of all others. It is best to build up a library of programs and routines. It is often necessary to mix techniques just as a conventional artist does. Use particular packages where you feel they suit the needs of the picture. For some pictures it helps to be able to see the entire screen – in this case, use *Freehand* or *Quest Paint*. *Quest Paint* and also the *Grafpad 2 Plus* software allow you to draw both straight and freehand lines of variable thickness, a useful feature I have not seen on other programs. Where an image needs to be enlarged, compressed, or squashed *Freehand* is probably best. For freer work, *Super Art* and *Quest Paint* are more suitable; their 'spray-can' option offers a range of effects similar to a soft crayon.

Until recently, *Super Art* was a 'standard', because of its pixel editor. Now



there's strong competition from *Quest Paint*. It incorporates many features not available in *Super Art*, such as the ability to 'protect' certain colours when drawing or erasing, and full screen working at all times. Many aspects of *Quest Paint* are easier to use than *Super Art*, in particular the loading and saving of screens.

Excellent though all these packages are, there's no denying one fact. The best way to draw pictures can often be to program them in. Many pictures begin life as a short program. I save the resulting image as a screen, and then load it into whichever package I'm going to use. Drawing shapes with Basic involves a core of no more than 20 or so commands, so it's not too difficult. It may seem paradoxical for an artist to advocate programming, but the first rule of computer graphics is to understand the technology and exploit its capabilities. If you don't, then you're wasting much of the machine's own special character.

What programming techniques do I recommend? Apart from the BBC micro's own Basic, the Computer Concepts *Graphics* ROM is an essential aid, particularly the CIRCLE, ARC, ROTATE and SCALE commands. Acorn's *GXR* ROM is a possible alternative, and it boasts one or two valuable commands for moving and copying areas of the screen.

I use a library of utility programs culled from various sources.

For some tasks, such as enlarging areas of the screen, rotating large areas and reducing screens to one-quarter size, I've written my own routines. The best advice is to keep a look out for useful hints and tips and keep them all together on a disc.

Transferring screen images onto paper can be a problem. Black and white illustrations are generally straightforward – one of the many screen dump programs is suitable for most purposes. If you're hoping to see your work in print, remember that newspapers and magazines may not always print pictures as clearly as you would like. Shaded areas can look particularly muddy, and thin lines sometimes disappear. Make your designs as bold as possible, and don't complicate them with too many tones. Using better quality paper and a new ribbon can help too.

One possible area of difficulty concerns the accurate reproduction of angles and circles. A circle on screen may not print perfectly round, and this can be awkward with technical designs. 'Proportional' screen dumps such as that by M A Jeffree of Oxford in May 1987's Hints & Tips get around this problem.

Colour output is more difficult: Dimension Graphics is the only company that I know of which produces colour prints to an acceptable quality for top class colour reproduction. Dimension Graphics prints BBC micro screens from disc, as well as Spectrum, Commodore, Amstrad CPC and IBM colour or enhanced graphics screens. The colour matching on these prints is not perfect, but if you have a masterpiece you want to hang in your living room, contact them. The Integrex colour printer is also capable of good quality screen dumps.

The system

Although I've done most of my work on a BBC micro, I've also used a number of other machines over the past few years. Most recent work has used a Tandon IBM clone, fitted with a hard disc and enhanced graphics adapter (EGA). Of the newer machines, the Amiga is most impressive. This is a computer designed for graphics; However, a computer's graphic capability is not the sole criterion when it comes to choosing a system.

What makes a machine useful is the amount of software and support is can use.



The picture of the Hayward Gallery (left), which is included on the *Acorn User Portfolio* disc, shows clearly the importance of perspective when drawing objects. Carefully choosing your subject is also vital – this picture consists almost entirely of straight lines, as does the stack of money (bottom right). The crowd scene (right) was built up by duplicating and then editing a few faces

This must include a well-documented Basic, plenty of books and magazines, utilities for printer dumps, file conversion and so on. Above all, it helps if you can turn to other people for advice. The BBC micro has all of these in abundance and it is this which has been an important factor in my being, until now, a faithful BBC micro user.

It is difficult to see how the Archimedes fits into the picture. However, its graphic abilities rival the Amiga and the IBM EGA models, and software is being developed by companies such as Clares and AMS.

The blank page

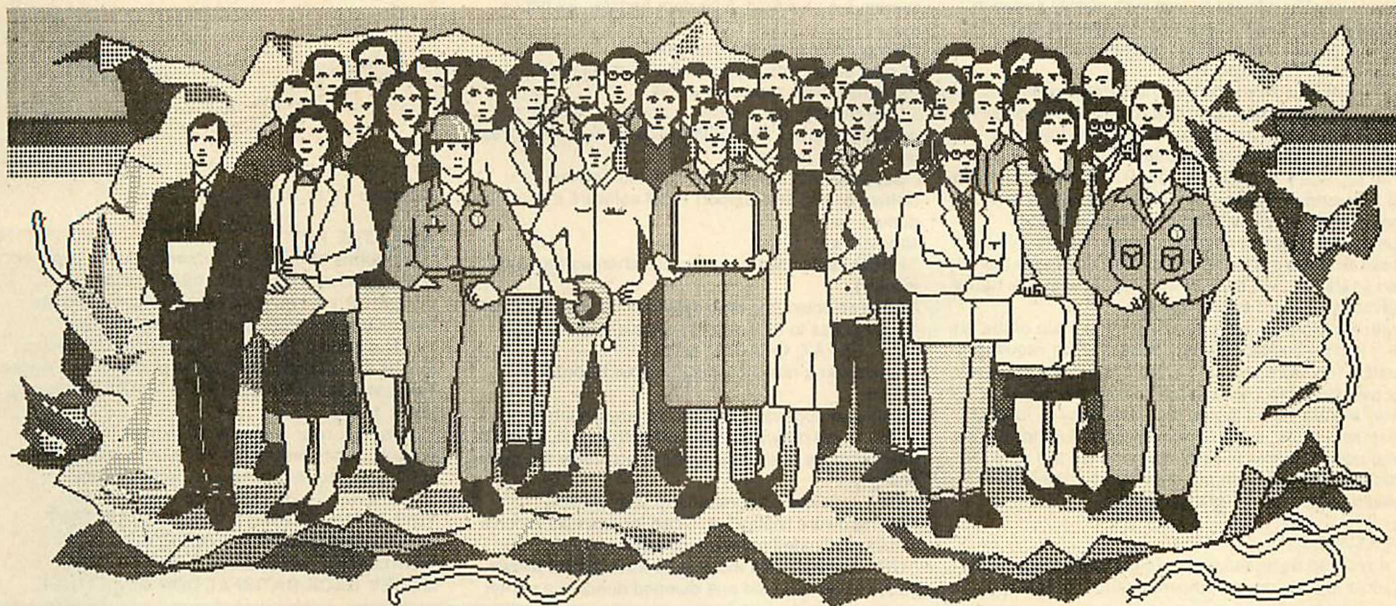
Choosing the right software and hardware is only part of the solution. Having set up your 'studio' you now face the age-old problem – the blank page.

So where do you start? First, a few words of caution. Drawing a picture with a computer can be more time-consuming than drawing by conventional means. Composition and design require careful thought. Second, there's still no substitute for good drawing skills. The computer screen can expose bad drawing remarkably easily. You have only a limited range of effects and these have to be employed very carefully. A computer will not produce brilliant results merely at the touch of a button.

On the positive side there are many suggestions for the budding artist. It's important to recognise what the machine is and isn't capable of. Try to plan your pictures so that they make the most of what you can do easily with your micro – such as repeating shapes. The crowd scene opposite uses only a few basic body elements; the figures are assembled from similar heads and legs. Carefully recolouring and flipping them creates the sense of variety. You don't have to use complex shapes; why not try to create landscapes or figures using two or three simple units, such as a cone, sphere and cube? Designing pictures using a limited range of shapes requires very careful thought, as those who've experimented with *Acorn User*'s *Kiddie Art* (February 1987) will testify.

Take a look at some 'Op Art', which was popular during the Sixties, in particular an artist like Victor Vasarely. Op Art effects are easy to recreate using textured fill patterns, in conjunction with even the simplest of shapes. Some programs such as *Super Plotter* or *Freehand*, allow you to stretch and enlarge shapes too, and remember that these can easily be rotated, mirrored and recoloured.

Some images occur regularly – figures, vehicles, computers and so on. Keep these as a 'cuttings' library. It's possible to build up whole pictures by collaging elements together – this is a very popular technique in advertising and animation. If you have a



digitiser, then you can cut figures and faces from frames grabbed from favourite TV programmes, and provide your own additions – speech bubbles perhaps. Always look for ways in which your computer's features can make life easier.

It is important also to recognise the machine's weaknesses too. The BBC micro's screen doesn't have the resolution or the colour range to reproduce the effect of a colour photograph. With a pencil and a sheet of paper you can create far more subtle shading effects than you can achieve with the most powerful micros. For this reason, don't try to copy photographs or paintings too slavishly. If you're looking for inspiration, look instead at pictures produced using simpler graphic techniques. Old advertising and film posters use a restricted range of colours to achieve dramatic results. Woodcuts and engravings, or other black and white illustrations will teach you a great deal. It's not necessary to draw everything with a black line around it. If you do, it often gives a cartoon-like effect. Certain objects in a picture can be drawn in black, as if in silhouette, with details drawn in white lines. This gives a bolder, more varied look.

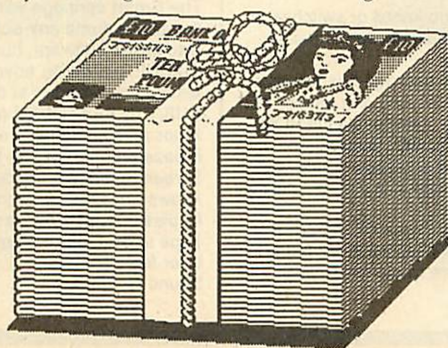
If you feel happier with black lines around everything, take a look at some Japanese prints. These are decorative and bright, and interesting to translate onto the computer screen.

When it comes to drawing, don't be afraid to use straight lines. Freehand drawing with a mouse is difficult, particularly for finer details. Instead, build up a shape using the straight line option in your package, drawing curves for example as a series of short steps. This way you can draw outlines relatively quickly. Straight lines don't always look out of place, and you can always iron out awkward edges with a pixel editor. Your micro screen simply cannot produce smooth curves, and it's not worth pretending that it can.

Embroidered textiles and carpets use techniques very similar to computer graphics. If you're designing sprites or small figures, you could do worse than take a look at Persian carpets, or those 'Home Sweet Home' tapestry and embroidery samplers. You'll be surprised at how good they look transferred to your screen. I've taken ideas from Indian miniatures and the Bayeux Tapestry with interesting results.

Colour is a problem, especially if you're aiming at a more realistic effect. The BBC micro has too limited a range of colours, so forget realism and experiment. Instead, look at your compositions in terms of the balance of colours. If you get this right, then people accept your choice of unrealistic colours. Unexpected colour combinations can produce quite atmospheric, even 'other worldly', effects.

For those determined to go for photographic realism, study screens produced by a video digitiser. A digitiser interprets the shades or tones of a video image as separate areas of colour. To get a feel for the effect, try looking at a coloured image on a monochrome monitor. The digitiser does the reverse – converting greys into colour. To imitate this then you need to consider your picture in terms of tones rather than lines. Now try to analyse a black and white photograph into four main shades; black, dark grey, light grey and white. These can then be translated for example into black, red, yellow and white on screen. Once you've done this, smooth off the hard edges with an airbrush effect mixing the various colours. Alternatively, reduce everything to just black and white for a much more dramatic effect.



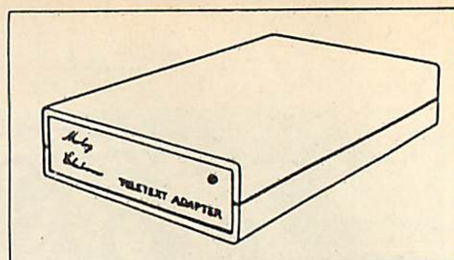
Finally a general point. One of the commonest traps to fall into with any drawing, not just on computers, is the temptation to cram in too much detail. Good drawing is nearly always a matter of knowing what to leave out. You don't need to put every detail in: the result can often just look lifeless. When drawing, why not try leaving gaps in your lines, dropping out a pixel here and there? It can open up your pictures and give them a sense of light and liveliness. With faces, avoid the temptation to draw every eyelash, especially when drawing pixel by pixel. Cartoons can teach you a great deal about how to draw pictures. A few lines can often convey a great deal more than a detailed portrait. A squiggle with the odd pixel coloured differently can be effectively used to suggest a figure in a landscape.

In this article I've only been able to suggest a few ideas to explore, but I hope they'll be enough to encourage readers to branch out from the usual space shuttles and racing cars. There are all sorts of styles and subjects just waiting for exploration. Above all be adventurous. Like the sheriff said, 'Draw'.

TELETEXT ADAPTER

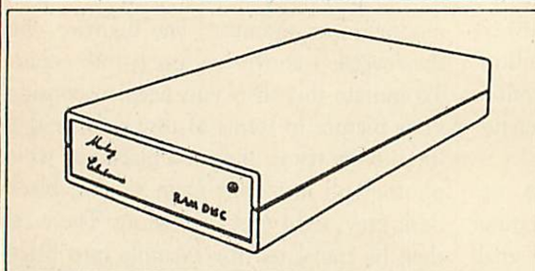
Would you like access to free high quality software and over a thousand pages of information, but Prestel access charges and phone bills too expensive? Then read on!
The answer is Teletext. Yes the same system everyone has seen incorporated into television sets, but with a difference. When Teletext is read by a computer you can actually use the data.
The MORLEY TELETEXT ADAPTER introduces you to the world of Teletext at a price that won't break the bank. Inside it you will find the latest in second generation Teletext chip technology, which unlike our rivals who are still using chips designed more than ten years ago, will be fully compatible with any future advances in the Teletext system.
With the Morley adapter you will get a state of the art unit that automatically tunes itself into the required station (no more messing around with screwdrivers or twiddling little knobs in the back of the case), a user friendly menu driven program, easy to follow instructions and a 12 month warranty. Add to this the free downloadable telesoftware and we are sure that you will agree that we are offering you one of the best bargains on the market today.

FEATURES:
* Advanced design uses the latest technology, will handle ANY future enhancements to the Teletext system e.g.: full field; 8 bit data transfer; 2k pages etc.
* Simply plugs into the user port.
* Low power consumption, less than 200ma. Optional power supply available.
* User friendly menu driven software including extended OSCLI and OSWord commands for access from BASIC programs.
* Supplied with 16k ATS (Advanced Teletext Software) and 16k support ROM software inc. printer dumps, page spoolers etc.
* FREE Telesoftware, no access charges (updated weekly).
* Save selected pages to disc/tape for later retrieval.
* Full access to all Teletext services and channels e.g.: CEEFAX, ORACLE, 4-TEL.
* Gives you a real-time clock at your disposal (*TIME).
* Software upgrades to allow for any enhancements to the Teletext service, e.g.: extra channels, full field data on cable & satellite systems etc. (only the media charge).
* Easy to follow comprehensive user guides.
* No hardware limitations, it can for example receive virtually unlimited numbers of channels.
* Utils disc available including printer drivers allows pages to be selected and dumped direct to a printer (no more TV or Radio Times to buy).



WHAT THE REVIEWERS SAID:
". . .In terms of price, performance, future expansion possibilities and those little touches that show thought for the end user I would recommend the Morley unit."–*(Acorn User, January, 1986).*
". . .The Morley unit has been designed to ensure that its operation is simple and smooth. It is the ideal Teletext adapter for school use."–*(A&B Computing, June, 1986).*
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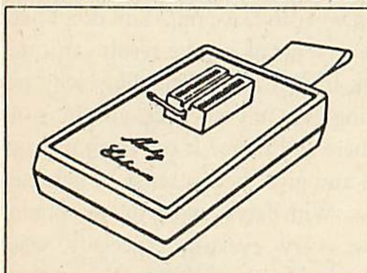
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Well that's the spec., add to this our usual 12 month no quibble guarantee and we're sure you'll agree the Morley RAMdisc is the sensible alternative if increased storage capacity and speed is your requirement.

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THE HARDWARE
The Unit is completely under software control, there are no knobs or switches to baffle the novice, and the extended features provided should excite the pro's.
THE SOFTWARE
The comprehensive user friendly software included in the package has two main parts, the first allows EPROMS to be read, programmed, verified and edited, also allowing a ROM image to be loaded or saved to disc. The second is a full ROM management system in its own right, which has a host of useful features and routines, such as KILL and RESURRECT ROM to disable or enable a sideways ROM, dump ROM image to buffer or disc, move ROM image in buffer to sideways RAM, and VIEW-SEARCH any sideways ROM.
.The whole system is available now for less than the price of one WORDWISE chip. So get yourself the all new MORLEY EPROM PROGRAMMER V2 today and start using those expansion boards for what they were made for! ROMS.
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MASTER CARTRIDGE

Designed and manufactured by Care Electronics to Acorn specifications. These high quality Master expansion cartridges will take two 16k sideways ROM's, and will, unlike similar cartridges available from other manufacturers, accept the new second generation programs, such as Computer Concepts Interword and Spellmaster ROM's.
These Cartridges come in a high quality, robust, formed-plastic case, that fits neatly into either one of the Master's cartridge slots.

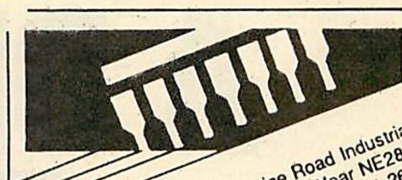
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This device was designed and manufactured jointly by Morley and Care Electronics.
The **Smart** cartridge will at the press of a button halt any program running in memory and execute any one of a host of useful built in, or user defined procedures, and once completed will return to the program and continue where it left off. The only limiting factor with this device is the programmers imagination.
The **Smart** cartridge will prive useful to the novice, allowing him to do the simple things like dump any screen to printer, and make backups of protected tape or disc based software, but has an open ended specification for the advanced 'HACKER' allowing advanced programming techniques to be incorporated into almost any program at the touch of a button.
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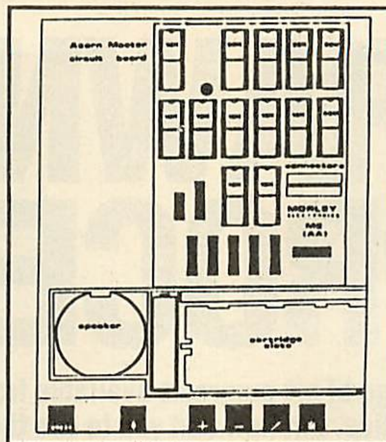


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NEW

MORLEY MASTER BOARD 'AA'



At long last the add-on all MASTER users have been waiting for, an internal ROM board.

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Included in the package is a utility ROM which has many useful features such as 'FICOPY', a clever file transfer program that transfers files between DFS and ADFS formats or vice versa.

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TELETEXT EMULATORS/SCREEN DISPLAYS/INFORMATION SYSTEMS – A complete range of teletext programs to cater for all needs, with full teletext adapter interfacing.

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AU12

A DRAWN-OUT PROCESS

There is a huge range of art programs avaliable from expensive packages to free utilities. But how can you to use them effectively?

Paul Bayley

In my days in the travel industry, I recall interminable hours spent meddling with Prestel's teletext graphics. The aim – a snappy holiday advertisement in the window overnight. If there was a queue outside the agency the following day, then it had been a success. This was my first attempt at graphic art on a computer; I liked it and I found an effective response could easily be achieved.

Now, based at home and enjoying new artistic freedom, doing something better on a BBC micro was a challenge.

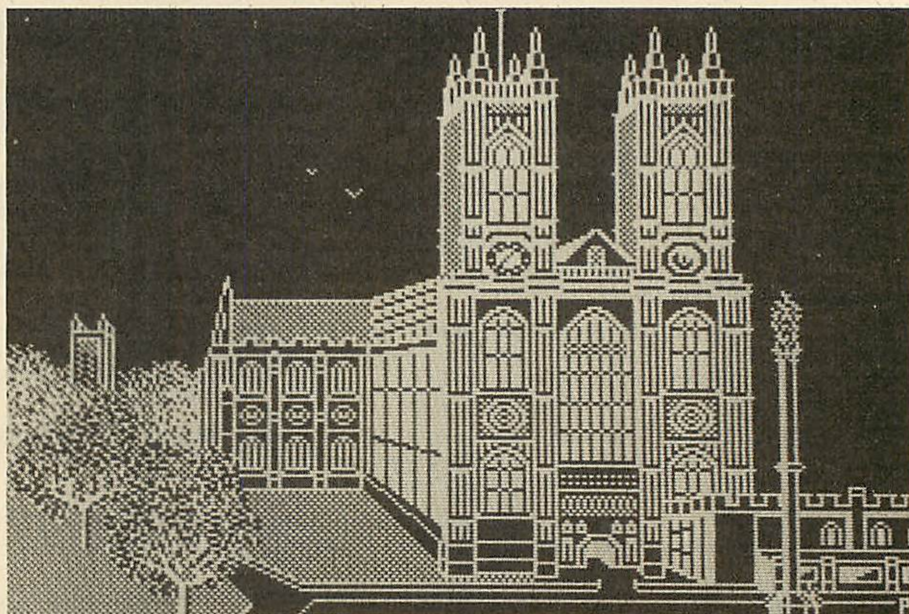
Motivated by those early creative efforts and armed only with residual drawing talent left over from school, I typed in a program from a magazine that seemed to offer some useful facilities. It resembled the now popular *AMX Super Art* package, but without colour. Some fairly appealing line drawings were made and subtly textured, but there was no facility to edit individual pixels. I was daunted by the prospect of having to reload and 'clean-up' my growing personal gallery later.

Other magazine programs were typed in and experimented with, but I still used a cassette system to store completed images. I found that a large colour monitor was a distinct advantage, as my drawings were becoming more and more detailed. And a disc drive helped store completed work faster and more reliably.

A cheap start

Typing in programs from magazines offers a cheap way to start, and some have quite sophisticated drawing facilities. But they don't compete with the best commercial packages. Intensive use of magazine drawing programs gave me a list of the most desirable features that should form the basis for future work. Speed of input, colour and a full-screen drawing area were my main considerations as I contemplated the move to a commercial package.

ILLUSTRATIONS BY PAUL BAYLEY



Architectural drawings can be effective in black and white

When you are ready to expand your drawing horizons, carefully scrutinise as many magazine reviews as possible. Study the advertisements – you'll generally find a discount somewhere to fit your pocket. If at all possible, get some hands-on experience at a dealers – and take a cue-card of questions. Don't be seduced into buying a paint package that contains features you don't need; go for one that supports most of your listed criteria. Remember though, whatever graphics package you purchase, you will find that there are limitations to every program. One package can't do it all – you have to use the best tool for individual jobs, so you may need to amass a 'toolbox' of programs from a variety of sources.

My toolbox comprises the *The Artist* package, plus a Wigmore mouse and a bank of utility programs accumulated from the pages of *Acorn User.*

The Artist is a 16k language ROM painting system designed for full-screen working in mode 2. The keyboard is used only to enter text or type in filenames – at all other times everything is controlled from the mouse via a system of menus. There are three individual menus; one for saving and loading, the main menu for drawing commands, a special effects menu for brushes, complex patterns and colours, plus the actual drawing page which is uncluttered by icons, menus or prompts.

Some surprising results have been achieved even in the 'lumpy' graphics of mode 2. Working in mode 1 or 0 is not supported by *The Artist*. I had to compromise on this when considering the purchase. Particularly useful is the choice of compressing the final image so it takes up minimum disc space, or leaving it uncom-

pressed for use by other programs. Screen dumps are provided for Epson printers, and eight sizes of picture dump with inverse, reverse and/or upside-down options. Although initially expensive, the outlay has been repayed, and the package has considerably influenced my artistic ambition.

The example colour pictures here were initially created in mode 2 using *The Artist* and then converted to mode 1. The monochrome pictures are in mode 4, and were drawn mostly with simple programs from magazines. They have each evolved out of a process of experimentation with utility programs that have appeared in *Acorn User*.

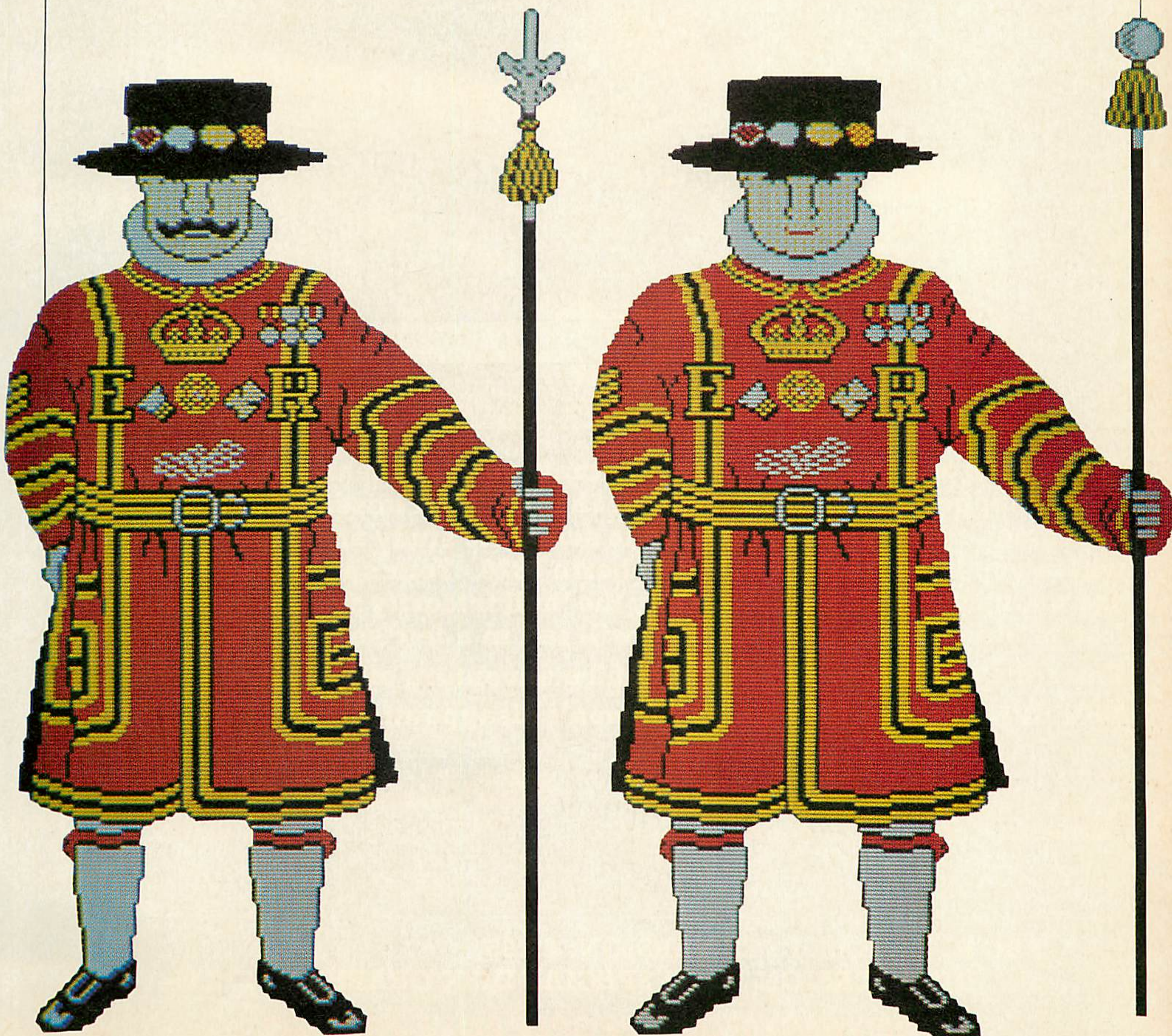
One of the most frequently used utilities has been Phil Wilkes' 'Art to Art Conversion' (*AU*, October 1986). This excellent program converts a mode 2 screen to either mode 0 or 1. Of course as the resolution increases the number of available colours decreases; this is compensated for by representing colours by different shading patterns. An originally cyan area will be converted to orange, a mixture of red and yellow. Green changes to cream and blue to a warm brown. The effects can give an entirely new look to a mode 2 screen.

Saving and loading of whole screens is catered for so that your final picture can be transferred to another art package or stored for for further enhancement. Only changes from a lower to a higher resolution are effected – there's no returning your newly saved mode 0 or 1 screen back to its original mode 2 state – so remember to keep your original.

A pixel editor

The other most frequently used utility is Mike William's pixel editor which was featured in the March 1986 edition of *Acorn User*. If you like your pictures as clean and clear as possible, then this pixel editor is the fine-tuning tool to so the job. The program will operate on a screen image in any of the graphics modes – 0,1,2,4 or 5.

The graphics screen is divided up into a large number of rectangles called pixels – short for picture elements. There are 320 across the screen in mode 1, and 256 down the screen, and each can be a different colour. It is difficult to alter an individual



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pixel from within your drawing program unless it has a 'zoom facility' built in. What this pixel editor does is to read a previously saved picture file. A large cursor box can then be moved over the screen to the box area that requires some attention. The area selected is magnified to fill the full screen, so that pixels become large enough to be seen and changed. The alterations to the magnified part are then copied back onto the original screen image. All very efficient and easy to use, but beware. You can so easily become locked into the editor for hours, as you persevere to achieve 'perfect' results. This has happened to me on several occasions. It's largely a case of trial and error but, once satisfied with, say, a particularly expressive face, do make a large enough screen dump for future reference. It will help you next time you come to edit a similar subject.

Flexible art package

One of the most flexible art package listings to appear in *Acorn User* was Chris Steele's *Freehand*. His initial program in October 1985 was followed in November by some additional utilities. This is the only other art program I use regularly, mainly to try out picture ideas, or to copy parts of pictures and 'import' them into other screens.

When selecting a subject to draw, people often go for familiar doodling subjects; cars, aeroplanes, or buildings. But more imaginative subjects are often more successful. I attempted to rework Lowry's *View of a Town* from a library book. The scene is of a typically stark northern town with very little colour and unusually few bent characters, so it appeared to offer a reasonable chance of success.

The result was a pleasing one but, before it could be published as a graphics bonus in July's *Acorn User* disc, approval had to be granted by the gallery where the original hangs. So beware of the paperwork if you try to emulate original works of art and publish the results.

Tourist postcards and guides are also good subjects, although generally small. I use a magnifying glass to examine the finer details. Another tip for getting a larger subject drawn is to use a clear acetate or plastic sheet, and trace most of the picture features. Tape this to the screen so it won't move and use that as a guide while using the drawing package.

Drawing a grid over the subject to match an on-screen grid is another way to get the perspective correct. A good tip is to draw a single grid and save it, then load this in every time you start a new picture. Above all, don't be over-enthusiastic; you often find the best images are those which tend to stand alone against a simple uncluttered background. In particular, architectural subjects lend themselves to the starkness and clarity of black and white.



L S Lowry's 'View of a Town' 1980s style

I generally have three graphics discs continually in use. Two contain drawings being worked upon and the third disc has a suite of frequently used utilities. The images at this stage are not compacted, it is only when I'm totally satisfied with the final result that they receive compaction and are placed on a separate gallery disc. An efficient graphics compaction is contained in Joe's Jottings, this month – it's a variation of the original SVPIC program by David Acton and Bruce Smith from *AU*, October 1986. The compacter will also save the current mode value and the colour palette details – these are used by the loader program to ensure that the compacted screen is returned in the correct mode and that the colours are all correct.

Screen dumping

Screen dumping of finished masterpieces can be achieved from within most art packages. However, for the ultimate in flexibility, it is best to fit a printer dump ROM. Watford's *Dumpout* ROM, Computer Concepts' *Printmaster* or *Acorn User's User Dump* all offer a good range of dump options but check each is compatable with your printer. By using different parameters with the command, a range of dump sizes and various special effects can usually be achieved. I've found it's also a good idea to set aside a disc and build up a collection of screen dump routines with which to experiment. These regularly appear in *Acorn User* and other computing magazines. Of particular interest were articles by Martin Phillips in the September 1986 and May 1987 issues. He compared 'standard' printer control codes, explained how screen dumps are programmed, and included example Basic and machine code routines.

May's article also carried an index of printer dump articles and listings, covering the last three years in *AU*. Printers cause more distress and confusion than almost all other problems put together.

Despite all of the difficulties, developing computer graphics is one of the most rewarding areas of computing – it can be great fun and not nearly as difficult as it first appears to be.

The Acorn User *articles and programs referred to by Paul Bayley are still available. Back issues of the magazines cost £1.75 in the UK, £2.25 in Europe and £3.75 elsewhere. Discs containing the programs from each issue are also available for £5.95 (Europe: £6.95, overseas: £7.95). For details of how to obtain them see the order form* *on page 129.*

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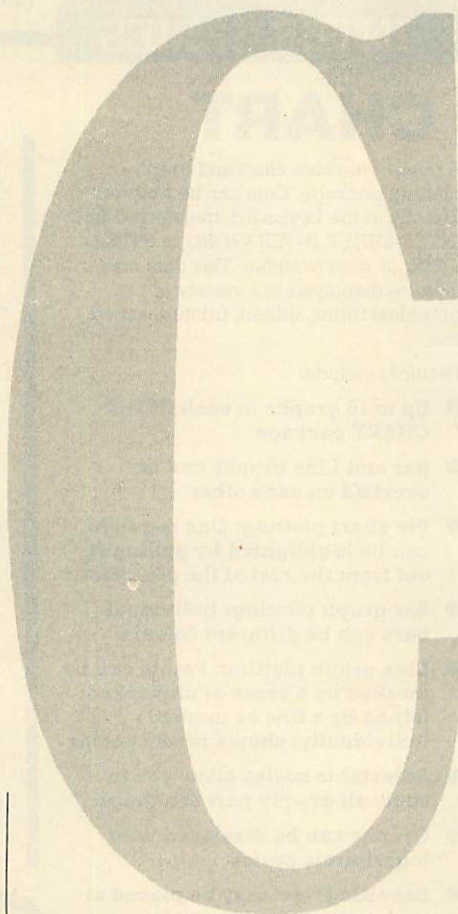
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COMPETITION

TEN C SEEKERS

Ten lucky readers will find copies of Acornsoft C worth £100 in their Christmas stockings thanks to *Acorn User*

Graham Bell



September's competition, which revolved around changing the base of numbers, proved extremely popular, and many entrants submitted programs that they had used to solve the problems. This month's competition is for those programmers – we want the shortest program that can change a number from one base to another.

The prizes this month are real programmer's treats: we have 10 copies of Acornsoft C to give away. This package is reviewed by Adam Denning on page 149 this month. C is the latest language for the BBC micro range. It's a fully structured, compiled language similar in some ways to Pascal, but offering greater facilitites for low-level access to the operating system and hardware. Acornsoft C has a wide range of control structures, functions and data-handling commands in line with the Kernighan and Ritchie standard, and offers some extensions included in the American National Standards Institute standard.

The aim of the competition is to write the shortest BBC Basic program that can convert any number from any base to any other base. It should be able to accept any integer bases from binary to hexadecimal (two to 16), and work with any integer from zero to a million (base 10).

Shortest will not be defined as the minimum length of the program in memory, because this encourages unreadable one line programs. Instead we will judge length by the minimum number of statements in the program. Basic statements have to be separated from each other by line numbers or colons. Statements are not the same as keywords – REPEAT UNTIL GET is three keywords, but only a single statement. This allows you plenty of scope for long variable names, and readable code.

The programs should run on a standard BBC model B, so Master or Archimedes owners should ensure that they don't use any of the unique features of their machines. After writing your program entry, send the listing in to us at 20-26 Brunswick Place, London N1 6DJ, on either paper, cassette or disc. Include your name and address, and if you want your entry returned, include return postage and packaging. Put the number of statements in your code on the outside of your entry.

The competition will be judged on Friday January 8 1988. The 10 winners will be those people who submit the shortest listings. In the event of a tie, then the winners will be drawn at random, and the editors decision will be final.









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YELLOW PAGES

INDEX/COMPATIBILITY

Entering listings

To make the task of entering listings easier, *Acorn User* has adopted several standards in the yellow pages. Programs are listed with line numbers in increments of 10, so type AUTO <Return> for automatic line numbering before you start. Before you list what you've entered, type LISTO 1 <Return> to provide spaces after the line numbers. Programs in the yellow pages are often listed to a width of 40 characters, so type MODE 6 <Return> before you start. Comparing the line-endings of your listing with the yellow pages will help you spot extra or missing characters.

To make sure that the program you want to enter will work on your particular machine, check the index below. All the listings work with Basic 1, 2 and 4 (unless stated otherwise) and with operating systems OS1.2 or above. If a program is accompanied by an article, please read the article first. If special care is needed when entering, we provide an easy-to-complete 'How To Enter' box.

Once you've typed in your program, save it to tape or disc then test it by running it. If you have a major problem with a listing, ask someone to check it. If you still have difficulties, you can also send off for a list of *Checksums* which help you find the errors. Send a large sae (26p stamp) to *AU*Checksums, PO Box 641, London NW9 8TF.

DISCS AND TAPES



All the listings on these pages can be found on this month's listings disc or cassette. See page 129 for details of how to order.

BACK ISSUES





For help with entering and debugging listings see the following back issues: April '86, June '85, Aug '84, Sept '83.

Program	Page	BBC B	B+/128	Master 128	Master Compact	Electron	6502SP/ Turbo	ADFS	Econet	Shadow RAM	Monthly T/D
Hints & Tips	114										
Listing 1		■	■	■	■		■	■	■	■	■
Listing 2						■					
Listings 3-5		■	■	■	■	■	■	■	■	■	■
First Byte	116										
Listing 1		■	■	■	■	■	■		■	■	■
Acorn Forum	117										
Listing 1[1]		■	■	■	■	■	■	■		■	■
Listing 2[2]		■	■	■	■	■	■	■	■	■	■
Listings 3,4		■	■	■	■	■	■	■	■	■	■
Listing 5				■	■			■	■	■	■
Joe's Jottings	122										
Listings 1-3			■	■			■	■	■	■	■
Graphics	128										
Listing 1[3]		■	■	■	■		■	■	■	■	■

Notes: [1] Program requires ADFS [2] Program requires *View* ROM [3] Requires plotter

See Hints & Tips, page 41

Listing 1. A simple synthesiser

```
   10 REM Hints & Tips -  Listing 1
   20 REM By Martin Phillips
   30 REM for B/B+/M/C
   40 REM (C) Acorn User December 1987
   50 :
   60 MODE 1
   70 PROCinitialise
   80 PROCscreen
   90 PROCprint
  100 PROCrun
  110 :
  120 DEF PROCinitialise
  130 DIM L%(32),M%(32),C%(32)
  140 ENVELOPE 1,2,0,0,0,0,0,0,127,-4,-4
,-10,126,50
  150 ENVELOPE 2,5,0,0,0,0,0,0,60,0,0,-1
0,126,126
  160 ENVELOPE 3,3,1,-1,1,1,2,1,75,0,0,-
75,126,126
  170 ENVELOPE 4,1,0,0,0,0,0,0,127,-1,-1
,-1,126,0
  180 octave=48
  190 VDU 23;8202;0;0;0;
  200 env=2
  210 FOR key=0 TO 32
  220 READ L%(key)
  230 M%(key)=0
  240 NEXT key
  250 DATA 2,17,66,34,82,51,52,68
  260 DATA 36,84,69,85,70,38,71,55
  270 DATA 87,88,72,73,57,89,41,74
  280 DATA 33,114,115,116,21,117,118,23,
119
  290 ENDPROC
  300 :
  310 DEF PROCscreen
  320 VDU 5
  330 VDU 19,0,4;0;
  340 VDU 19,2,0;0;
  350 VDU 24,0;256;1279;896;
  360 GCOL 0,131
  370 CLG
  380 FOR N%=1 TO 5
  390 READ start
  400 VDU 24,start;512;start+64;896;
  410 GCOL 0,130
  420 CLG
  430 VDU 24,start+672;512;start+736;896
;
  440 GCOL 0,130
  450 CLG
  460 NEXT N%
  470 DATA 32,128,320,416,512
  480 VDU 26
  490 GCOL 0,2
  500 FOR N%=0 TO 12
  510 MOVE (64+N%*96).256
  520 DRAW (64+N%*96),896
  530 NEXT N%
  540 GCOL 0,3
  550 MOVE 48,936
  560 PRINT "Q  W     R  T  Y     I  O
 @  [  _"
  570 MOVE 0,240
  580 PRINT "C  A  S  D  F  G  H  J  K
L  ;  :  ]  R";
  590 PRINT "T";SPC(38);"E";
  600 PRINT "R";SPC(38);"T";
  610 PRINT "L";SPC(38);"N";
  620 COLOUR 2
  630 MOVE 462,992
  640 PRINT "SYNTHESISER"
  650 VDU 4
```

Continued ▶

◀ Hints & Tips listing 1 continued

```
  660 ENDPROC
  670 :
  680 DEF PROCrun
  690 REPEAT
  700 FOR key=0 TO 32
  710 IF INKEY(-L%(key))=(M%(key)=0) THE
N PROCsound
  720 NEXT key
  730 UNTIL 0
  740 :
  750 DEF PROCsound
  760 IF key>26 THEN PROCenv:ENDPROC
  770 IF key>23 THEN PROCoctave:ENDPROC
  780 IF M%(key)<>0 THEN PROCoff:ENDPROC
  790 J%=0
  800 REPEAT
  810 J%=J%+1
  820 UNTIL J%=4 OR C%(J%)=0
  830 IF J%>3 THEN ENDPROC
  840 C%(J%)=-1
  850 M%(key)=J%
  860 SOUND J%,env,octave+4*key,-1
  870 ENDPROC
  880 :
  890 DEF PROCenv
  900 env=key-26
  910 PROCprint
  920 ENDPROC
  930 :
  940 DEF PROCoctave
  950 octave=48*(key-24)
  960 PROCprint
  970 ENDPROC
  980 :
  990 DEF PROCoff
 1000 J%=M%(key)
 1010 M%(key)=0
 1020 C%(J%)=0
 1030 SOUND &1010+J%,0,0,0
 1040 ENDPROC
 1050 :
 1060 DEF PROCprint
 1070 RESTORE 1170
 1080 FOR N=0 TO 6
 1090 READ key$,desc$,xpos,ypos
 1100 COLOUR 1
 1110 PRINT TAB(xpos,ypos);key$;
 1120 COLOUR 2
 1130 IF N=env+2 THEN COLOUR 3
 1140 IF N<3 AND octave DIV48 =N THEN CO
LOUR 3
 1150 PRINT TAB(xpos+3,ypos);desc$;
 1160 NEXT N
 1170 DATA f0,Low octaves,4,28
 1180 DATA f1,Middle octaves,20,28
 1190 DATA f2,High octaves,4,29
 1200 DATA f3,Piano,4,30
 1210 DATA f4,Organ,20,30
 1220 DATA f5,Vibraphone,4,31
 1230 DATA f6,Chime bars,20,31
 1240 ENDPROC
```

Listing 2. Electron synthesiser

```
   10 REM Hints & Tips -  Listing 2
   20 REM By Martin Phillips
   30 REM for Electron
   40 REM (C) Acorn User December 1987
   50 :
   60 MODE 1
   70 PROCinitialise
   80 PROCmachinecode
   90 PROCscreen
```

Continued ▶

◀ Hints & Tips listing 2 continued

```
100 REPEAT
110 PROCmain
120 UNTIL FALSE
130 :
140 DEF PROCinitialise
150 ENVELOPE 1,1,0,0,0,0,0,0,126,0,0,-
126,126,126
160 R%=590
170 J%=0
180 flag=0
190 VDU 23,1,0;0;0;0;
200 FOR A%=0 TO 19
210 READ B%
220 A%?&C80=-B%
230 NEXT A%
240 DATA 17,66,34,82,35,51,68,36,84,69
250 DATA 85,70,38,71,55,87,56,88,73,42
260 ENDPROC
270 :
280 DEF PROCmachinecode
290 FOR I%=0 TO 2 STEP2
300 P%=&C00
310 [OPT I%
320 LDA #0
330 STA &74
340 STA &75
350 LDA #255
360 STA &70
370 .osbyte
380 LDX &75
390 LDA &C80,X
400 TAX
410 LDY #255
420 LDA #&81
430 JSR &FFF4
440 CPX #0
450 BEQ next
460 LDX &74
470 LDA &75
480 STA &70,X
490 RTS
500 .next
510 INC &75
520 LDA &75
530 CMP #20
540 BNE osbyte
550 RTS
560 ]
570 NEXT I%
580 ENDPROC
590
600 DEF PROCwait
610 TIME=0
620 REPEAT UNTIL TIME=50
630 ENDPROC
640
650 DEF PROCscreen
660 VDU 19,0,4;0;
670 VDU 19,2,0;0;
680 VDU 24,112;256;1168;768;
690 GCOL 0,131
700 CLG
710 FOR N%=1 TO 9
720 READ start,end
730 VDU 24,start;512;end;768;
740 GCOL 0,130
750 CLG
760 NEXT N%
770 DATA 112,144,176,240,272,339
780 DATA 464,528,560,624
790 DATA 752,816,848,912,944,1008
800 DATA 1136,1168
810 VDU 26
820 GCOL 0,2
```

Continued ▶

◀ Hints & Tips listing 2 continued

```
830 FOR N%=1 TO 10
840 MOVE (112+N%*96),256
850 DRAW (112+N%*96),768
860 NEXT N%
870 GCOL 0,3
880 PRINT TAB(4,6);"Q W  E     T  Y
I  O  P    }"
890 PRINTTAB(5,26)"A  S  D  F  G  H  J
K  L  ;  :"
900 COLOUR 2
910 PRINT TAB(13,2);"ELECTRON ORGAN"
920 PRINT TAB(6,30);"Press SHIFT to ch
ange pitch";
930 ENDPROC
940 :
950 DEF PROCmain
960 IF INKEY(-1) THEN flag=(flag+1)MOD
2:PROCwait
970 CALL &C00
980 Z%=28+flag*84
990 IF ?&70<255 THEN SOUND &11,1,?&70*
4+Z%,3
1000 ENDPROC
```

Listing 3. Guess a number

```
10 REM Hints & Tips Listing 3
20 REM By Martin Phillips
30 REM for B/B+/M/C/E
40 REM (C) Acorn User December 1987
50 :
60 @%=0
70 MODE 7
80 PROCscreen
90 PROCrun
100 PRINT '"Want another game? (Y/N):
";
110 in$=GET$
120 IF (in$="Y") OR (in$="y") THEN RUN
130 MODE 7
140 END
150 :
160 DEF PROCscreen
170 PRINT TAB(12,1);CHR$141;"Guess a N
umber"
180 PRINT TAB(12,2);CHR$141;"Guess a N
umber"
190 VDU 28,0,24,39,4
200 ENDPROC
210 :
220 DEF PROCrun
230 X=RND(-TIME)
240 number=RND(100)
250 count=0
260 REPEAT
270 count=count+1
280 INPUT '"Guess a number: "guess
290 IF guess<number THEN PROClow
300 IF guess>number THEN PROChigh
310 UNTIL guess=number
320 PRINT ''"Well done"
330 PRINT "You had ";count;" goes."
340 ENDPROC
350 :
360 DEF PROClow
370 SOUND 1,-15,4,10
380 PRINT '"Too low"
390 ENDPROC
400 :
410 DEF PROChigh
420 SOUND 1,-15,148,10
430 PRINT '"Too high"
440 ENDPROC
```

Listing 4. Hexadecimal/denary converter

```
   10 REM Hints & Tips Listing 4
   20 REM By Martin Phillips
   30 REM for B/B+/M/C/E
   40 REM (C) Acorn User December 1987
   50 :
   60 MODE 7
   70 PRINT TAB(12,1);CHR$141;"Hex Conve
rter"
   80 PRINT TAB(12,2);CHR$141;"Hex Conve
rter"
   90 VDU 28,0,24,39,5
  100 :
  110 REPEAT
  120 REPEAT
  130 INPUT '"Enter a number: "num$
  140 UNTIL LEN(num$)>0
  150 PRINT num$ " = ";
  160 IF LEFT$(num$,1)="&" THEN PROChex
ELSE PROCden
  170 UNTIL FALSE
  180 :
  190 END
  200 :
  210 DEF PROChex
  220 PRINT;EVAL(num$)
  230 ENDPROC
  240 :
  250 DEF PROCden
  260 PRINT "&";~VAL(num$)
  270 ENDPROC
```

Listing 5. Reaction timer

```
   10 REM Hints & Tips Listing 5
   20 REM By Martin Phillips
   30 REM for B/B+/M/C/E
   40 REM (C) Acorn User December 1987
   50 :
   60 DIM D 8
   70 MODE 1
   80 PROCscreen
   90 PROCrun
  100 END
```

Continued ►

◄ Hints & Tips listing 5 continued

```
  110 :
  120 DEF PROCscreen
  130 VDU 19,0,7;0;
  140 VDU 19,3,4;0;
  150 PROCdouble("Reaction Timer",13,1)
  160 PRINT '’"  Press the space bar whe
n the block"
  170 PRINT "  appears."
  180 VDU 28,0,31,39,8
  190 VDU 23,1,0;0;0;0;
  200 ENDPROC
  210 :
  220 DEF PROCrun
  230 GCOL 0,129
  240 REPEAT
  250 TIME=0
  260 REPEAT UNTIL TIME=200+RND(1000)
  270 VDU 24,400;200;800;600;
  280 CLG
  290 *FX 21,0
  300 TIME=0
  310 REPEAT UNTIL GET=32
  320 PRINT TAB(7,20)"Your time was ";TI
ME/100;" secs."
  330 REPEAT UNTIL GET=32
  340 CLS
  350 UNTIL FALSE
  360 ENDPROC
  370 :
  380 DEF PROCdouble(A$,x,y)
  390 X%=D MOD 256
  400 Y%=D DIV 256
  410 A%=10
  420 C$=CHR$(240)+CHR$8+CHR$10+CHR$(241
)
  430 FOR N%=1 TO LEN(A$)
  440 B$=MID$(A$,N%,1)
  450 ?D=ASC(B$)
  460 CALL &FFF1
  470 VDU 23,240,D?1,D?1,D?2,D?2,D?3,D?3
,D?4,D?4
  480 VDU 23,241,D?5,D?5,D?6,D?6,D?7,D?7
,D?8,D?8
  490 PRINT TAB(x+N%-1,y);C$
  500 NEXT
  510 ENDPROC
```

See First Byte, page 47

Listing 1. *DUMP routine

```
   10 REM *DUMP command
   20 REM by Tessie Revi
vis
   30 REM for B/B+/M/C/E
   40 REM (c) Acorn User
 Dec 1987
   50 :
   60 org=&900
   70 :
   80 offset=&70
   90 handle=&72
  100 end=&73
  110 :
  120 osfind=&FFCE
  130 osbget=&FFD7
  140 osnewl=&FFE7
  150 oswrch=&FFEE
  160 osword=&FFF1
  170 osbyte=&FFF4
  180 :
  190 FOR pass=0 TO 3 ST
EP 3
  200 P%=org
  210 [OPT pass
  220 LDX #0
  230 .messprt
  240 LDA prompt,X
  250 BEQ messdn
  260 JSR oswrch
  270 INX
  280 BNE messprt
  290 .messdn
  300 LDX #wblk MOD &100
  310 LDY #wblk DIV &100
  320 LDA #0
  330 JSR osword
  340 BCC open
  350 JMP escape
  360 :
  370 .open
  380 LDX #lbuff MOD &10
0
  390 LDY #lbuff DIV &10
0
  400 LDA #&40
  410 JSR osfind
  420 CMP #0
  430 BNE fileok
  440 BRK
  450 EQUB 0
  460 EQUS "File not fou
nd"
  470 EQUB 0
  480 :
  490 .fileok
  500 STA handle
  510 LDA #0
  520 STA offset
  530 STA offset+1
  540 LDA #&FF
  550 STA end
  560 .loop
  570 :
  580 LDA #&7F
  590 LDX handle
  600 JSR osbyte
```

Continued ►

◀ First Byte listing 1 continued

```
610 TXA
620 BEQ notdn
630 .exit
640 LDY handle
650 LDA #0
660 JMP osfind
670 :
680 .notdn
690 LDA offset+1
700 JSR hexprt
710 LDA offset
720 JSR hexprt
730 LDA #ASC" "
740 JSR oswrch
750 JSR oswrch
760 LDX #0
770 .loop2
780 LDY handle
790 JSR osbget
800 BCC gotok
810 STX end
820 BCS pad
830 .gotok
840 STA buffer,X
850 JSR hexprt
860 LDA #ASC" "
870 JSR oswrch
880 INX
890 CPX #8
900 BNE loop2
910 .pad
920 CPX #8
930 BEQ paddn
940 LDA #ASC" "
950 JSR oswrch
960 JSR oswrch
970 JSR oswrch
980 INX
990 BNE pad
1000 :
1010 .paddn
1020 LDA #ASC" "
1030 JSR oswrch
1040 LDX #0
1050 .loop3
1060 :
1070 CPX end
1080 BEQ ascdn
1090 LDA buffer,X
1100 CMP #&7F
1110 BCS illegal
1120 CMP #ASC" "
1130 BCS charok
1140 .illegal
1150 LDA #ASC"."
1160 .charok
1170 JSR oswrch
1180 INX
1190 CPX #8
1200 BNE loop3
1210 .ascdn
1220 JSR osnewl
1230 BIT &FF
1240 BPL notesc
1250 .escape
1260 BRK
1270 EQUB 17
1280 EQUS "Escape"
1290 EQUB 0
1300 :
1310 .notesc
1320 LDA end
1330 BPL exit
1340 LDA offset
1350 CLC
1360 ADC #8
1370 STA offset
1380 BCC nothi
1390 INC offset+1
1400 .nothi
1410 JMP loop
1420 :
1430 .hexprt
1440 :
1450 PHA
1460 LSR A
1470 LSR A
1480 LSR A
1490 LSR A
1500 JSR hexprt2
1510 PLA
1520 AND #&F
1530 :
1540 .hexprt2
1550 ORA #ASC"0"
1560 CMP #ASC"9"+1
1570 BCC hexprt3
1580 ADC #6
1590 .hexprt3
1600 JMP oswrch
1610 :
1620 .prompt
1630 EQUS "Enter filena
me : "
1640 EQUB 0
1650 :
1660 .wblk
1670 :
1680 EQUW lbuff
1690 EQUB 16
1700 EQUB 32
1710 EQUB 255
1720 :
1730 .lbuff
1740 :
1750 EQUS STRING$(16,"
")
1760 :
1770 .buffer
1780 :
1790 EQUS STRING$(8," "
)
1800 :
1810 ]
1820 NEXT
1830 :
1840 REM Checksum
1850 FOR I%=org TO P%-1
1860 P%=P%+?I%
1870 NEXT
1880 IF P%<>33806 PRINT
"Error in code - Please
check it.":END
1890 *SAVE OSDUMP 900 A
1E
```

See Acorn Forum, page 53

Listing 1. Broken directory fixer

```
10 REM Broken Directo
ry Fixer
20 REM by Stephen Oxl
ey
30 REM for B/B+/E/M/C
 with ADFS
40 REM (C) Acorn User
 December 1987
50 :
60 PROCsetup
70 PROCassemble
80 PROCcheck
90 A$="SAVE FIX "+STR
$~code%+" +336 FFFF"+sta
rt$+" FFFF"+start$
100 PRINT A$
110 OSCLI A$
120 END
130 :
140 DEF PROCsetup
150 start$="0E00"
160 osasci=&FFE3
170 osargs=&FFDA
180 osgbpb=&FFD1
190 drive=&70
200 osword=&FFF1
210 nameptr=&7E
220 name=&71
230 end=&7C
240 length=&7D
250 offset=&80
260 byte=&82
270 temp=&83
280 ENDPROC
290 :
300 DEF PROCassemble
310 DIM code% &3FF
320 FOR pass=4 TO 7 ST
EP 3
330 P%=EVAL("&"+start$
)
340 O%=code%
350 [OPT pass
360 JMP begin
370 JMP fix
380 .begin
390 JSR setupvars
400 LDX #nameptr
410 LDY #0
420 LDA #1
430 JSR osargs
440 JSR skipspaces
450 CMP #13
460 BEQ noname
470 CMP #ASC "$"
480 BNE c1
490 JSR add
500 JSR skipspaces
510 CMP #13
520 BEQ noname
530 CMP #ASC "."
540 BNE noname
550 JSR skipspaces
560 CMP #13
570 BNE c1
580 .noname
590 JMP nonamem
600 .notfound
610 JMP nfound
620 .c1
```

Continued ▶

◄ Acorn Forum listing 1 continued

```
 630 LDA #2
 640 STA sector+2
 650 .getname
 660 LDY #0
 670 .gnloop
 680 JSR getchr
 690 CMP #ASC("a")-1
 700 BMI g2
 710 CMP #ASC("z")+1
 720 BPL g2
 730 AND #&DF
 740 .g2
 750 CMP #32
 760 BEQ noname
 770 JSR add
 780 STA name,Y
 790 INY
 800 STY length
 810 CMP #ASC "."
 820 BEQ endname
 830 CMP #13
 840 BEQ endstring
 850 JMP gnloop
 860 .endstring
 870 DEC length
 880 LDA length
 890 CMP #0
 900 BEQ noname
 910 CMP #11
 920 BMI c2
 930 LDA #10
 940 STA length
 950 .c2
 960 INC end
 970 JMP c3
 980 .endname
 990 DEC length
 1000 LDA length
 1010 CMP #0
 1020 BEQ noname
 1030 CMP #11
 1040 BMI c3
 1050 LDA #10
 1060 STA length
 1070 .c3
 1080 JSR skipspaces
 1090 CMP #13
 1100 BEQ noname
 1110 CMP #ASC "."
 1120 BEQ noname
 1130 JSR getsectors
 1140 LDX #discbuffer MO
D 256
 1150 STX offset
 1160 LDY #discbuffer DI
V 256
 1170 STY offset+1
 1180 JSR add2
 1190 JSR add4
 1200 .msl
 1210 LDY #3
 1220 LDA (offset),Y
 1230 AND #&80
 1240 STA byte
 1250 LDY #0
 1260 LDA (offset)
 1270 CMP #0
 1280 BNE search
 1290 JMP notfound
 1300 .search
 1310 JSR getchr2
 1320 AND #&7F
 1330 CMP #ASC("a")-1
 1340 BMI g3
 1350 CMP #ASC("z")+1
 1360 BPL g3
 1370 AND #&DF
 1380 .g3
 1390 STA temp
 1400 LDA name,Y
 1410 INY
 1420 CMP temp
 1430 BNE next
 1440 CPY length
 1450 BEQ found
 1460 JMP search
 1470 .next
 1480 CPY #10
 1490 BEQ n2
 1500 JSR add2
 1510 INY
 1520 JMP next
 1530 .n2
 1540 JSR skip
 1550 JMP msl
 1560 .notdir
 1570 BRK
 1580 EQUB 254
 1590 EQUS "This is not
a directory"
 1600 BRK
 1610 .found
 1620 LDA byte
 1630 BEQ notdir
 1640 .f1
 1650 CPY #10
 1660 BEQ in
 1670 JSR add2
 1680 INY
 1690 JMP f1
 1700 .in
 1710 JSR add4
 1720 JSR add4
 1730 JSR add4
 1740 JSR getchr2
 1750 STA sector+2
 1760 JSR getchr2
 1770 STA sector+1
 1780 JSR getchr2
 1790 STA sector
 1800 JSR add2
 1810 LDA end
 1820 BNE goandcure
 1830 JMP getname
 1840 .goandcure
 1850 JSR getsectors
 1860 LDX #discbuffer MO
D 256
 1870 STX offset
 1880 LDY #discbuffer DI
V 256
 1890 STY offset+1
 1900 LDA #0
 1910 STA (offset)
 1920 JSR add2
 1930 JSR hugo
 1940 LDX #1228 MOD 256
 1950 LDY #1228 DIV 256
 1960 JSR addv
 1970 JSR namestamp
 1980 LDX #1241 MOD 256
 1990 LDY #1241 DIV 256
 2000 JSR addv
 2010 JSR namestamp
 2020 LDX #1274 MOD 256
 2030 LDY #1274 DIV 256
 2040 JSR addv
 2050 LDA #0
 2060 STA (offset)
 2070 JSR add2
 2080 JSR hugo
 2090 LDA #0
 2100 STA (offset)
 2110 LDA #&0A
 2120 STA secbuf+5
 2130 LDA sector
 2140 ORA drive
 2150 STA sector
 2160 LDA #114
 2170 LDX #secbuf MOD 25
6
 2180 LDY #secbuf DIV 25
6
 2190 JSR osword
 2200 LDA secbuf
 2210 BNE err
 2220 LDY #0
 2230 .donel
 2240 LDA done,Y
 2250 INY
 2260 JSR osasci
 2270 CMP #13
 2280 BEQ out
 2290 JMP donel
 2300 .done
 2310 EQUS "Directory fi
xed!"
 2320 EQUB 13
 2330 .out
 2340 RTS
 2350 .fix
 2360 JSR setupvars
 2370 LDA #2
 2380 STA sector+2
 2390 JMP goandcure
 2400 .skipspaces
 2410 JSR getchr
 2420 JSR add
 2430 CMP #13
 2440 BEQ outs
 2450 CMP #ASC "."
 2460 BEQ outs
 2470 CMP #32
 2480 BEQ skipspaces
 2490 PHA
 2500 JSR dec
 2510 PLA
 2520 .outs
 2530 RTS
 2540 .nfound
 2550 BRK
 2560 EQUB 254
 2570 EQUS "Directory no
t found"
 2580 BRK
 2590 .nonamem
 2600 BRK
 2610 EQUB 254
 2620 EQUS "Path not spe
cified properly"
 2630 BRK
 2640 .err
 2650 BRK
 2660 EQUB 254
 2670 EQUS "ADFS disc er
ror!"
 2680 BRK
 2690 .getchr
 2700 PHX
 2710 PHY
 2720 LDX #nameptr MOD 2
56
```

Continued ►

◀ Acorn Forum listing 1 continued

```
 2730 LDY #nameptr DIV 2
56
 2740 LDA #5
 2750 JSR osword
 2760 LDA nameptr+4
 2770 PLY
 2780 PLX
 2790 RTS
 2800 .getsectors
 2810 LDA #8
 2820 STA secbuf+5
 2830 LDA sector
 2840 ORA drive
 2850 STA sector
 2860 LDA #114
 2870 LDX #secbuf MOD 25
6
 2880 LDY #secbuf DIV 25
6
 2890 JSR osword
 2900 LDA secbuf
 2910 BNE err
 2920 RTS
 2930 .add2
 2940 PHA
 2950 CLC
 2960 LDA offset
 2970 ADC #1
 2980 STA offset
 2990 LDA offset+1
 3000 ADC #0
 3010 STA offset+1
 3020 PLA
 3030 RTS
 3040 .skip
 3050 PHA
 3060 CLC
 3070 LDA offset
 3080 ADC #16
 3090 STA offset
 3100 LDA offset+1
 3110 ADC #0
 3120 STA offset+1
 3130 PLA
 3140 RTS
 3150 .getchr2
 3160 LDA (offset)
 3170 JSR add2
 3180 RTS
 3190 .add4
 3200 PHA
 3210 CLC
 3220 LDA offset
 3230 ADC #4
 3240 STA offset
 3250 LDA offset+1
 3260 ADC #0
 3270 STA offset+1
 3280 PLA
 3290 RTS
 3300 .hugo
 3310 LDY #0
 3320 .hugoloop
 3330 LDA hugom,Y
 3340 STA (offset)
 3350 JSR add2
 3360 INY
 3370 CPY #4
 3380 BNE hugoloop
 3390 RTS
 3400 .hugom
 3410 EQUS "Hugo"
 3420 .addv
 3430 PHX
 3440 PHY
 3450 LDX #discbuffer MO
D 256
 3460 STX offset
 3470 LDY #discbuffer DI
V 256
 3480 STY offset+1
 3490 PLY
 3500 PLX
 3510 TXA
 3520 CLC
 3530 ADC offset
 3540 STA offset
 3550 LDA offset+1
 3560 ADC #0
 3570 STA offset+1
 3580 TYA
 3590 CLC
 3600 ADC offset+1
 3610 STA offset+1
 3620 RTS
 3630 .namestamp
 3640 LDY #0
 3650 .nloop
 3660 LDA name,Y
 3670 STA (offset)
 3680 JSR add2
 3690 INY
 3700 CPY length
 3710 BNE nloop
 3720 LDA #13
 3730 STA (offset)
 3740 JSR add2
 3750 RTS
 3760 .setupvars
 3770 LDX #0
 3780 LDA #0
 3790 STA sector
 3800 STX sector+1
 3810 STA nameptr+2
 3820 STA nameptr+3
 3830 STA nameptr+4
 3840 LDX #buffer MOD 25
6
 3850 LDY #buffer DIV 25
6
 3860 STX tempbuff
 3870 STY tempbuff+1
 3880 LDX #0
 3890 STX tempbuff+2
 3900 LDX #tempbuff MOD
256
 3910 LDY #tempbuff DIV
256
 3920 JSR osgbpb
 3930 LDA buffer+4
 3940 ASL A
 3950 ASL A
 3960 ASL A
 3970 ASL A
 3980 ASL A
 3990 STA drive
 4000 STZ end
 4010 RTS
 4020 .add
 4030 PHA
 4040 CLC
 4050 LDA nameptr
 4060 ADC #1
 4070 STA nameptr
 4080 LDA nameptr+1
 4090 ADC #0
 4100 STA nameptr+1
 4110 PLA
 4120 RTS
 4130 .dec
 4140 PHA
 4150 SEC
 4160 LDA nameptr
 4170 SBC #1
 4180 STA nameptr
 4190 LDA nameptr+1
 4200 SBC #0
 4210 STA nameptr+1
 4220 PLA
 4230 RTS
 4240 .tempbuff
 4250 EQUD 0
 4260 .buffer
 4270 EQUD 0
 4280 EQUD 0
 4290 .secbuf
 4300 EQUB 0
 4310 EQUD discbuffer
 4320 EQUB 0
 4330 .sector
 4340 EQUD 0
 4350 EQUB 0
 4360 EQUD 1280
 4370 .discbuffer
 4380 BRK
 4390 ] NEXT
 4400 ENDPROC
 4410 :
 4420 DEF PROCcheck
 4430 sum%=0
 4440 FOR I%=code% TO O%
-1
 4450 sum%=sum%+?I%
 4460 NEXT
 4470 IF sum%=79040 THEN
ENDPROC
 4480 PRINT"Checksum err
or - please check listin
g"
```

Listing 2. NLQ/italic printer driver

```
   10 REM NLQ/Italic pri
nter driver
   20 REM by Stuart Roge
rs
   30 REM for B/B+/E/M/C
 + VIEW
   40 REM (c) Acorn User
 December 1987
   50 :
   60 DIM space &FF
   70 oswrch=&FFEE
   80 :
   90 FOR pass=0 TO 3 ST
EP 3
  100 P%=space
  110 offset=space-&400
  120 [OPT pass
  130 JMP wrch-offset
  140 JMP printeron-offs
et
  150 JMP printeroff-off
set
  160 RTS
```

Continued ▶

◄ Acorn Forum listing 2 continued

```
170 NOP
180 NOP
190 RTS
200 .toggle
210 EQUB 128
220 .char
230 EQUB 0
240 :
250 .printeron
260 LDA #2
270 JSR oswrch
280 LDA #&80
290 STA toggle-offset
300 LDX #0
310 JMP outseq-offset
320 .printeroff
330 LDA #3
340 JMP oswrch
350 :
360 .wrch
370 STA char-offset
380 PHP
390 PHA
400 TXA
410 PHA
420 TYA
430 PHA
440 LDA char-offset
450 CMP #&80
460 BNE tryital
470 LDX #(ulon-setup)
480 LDA toggle-offset
490 AND #1
500 BEQ gotcode1
510 LDX #(uloff-setup)
520 .gotcode1
530 JSR outseq-offset
540 LDA toggle-offset
550 EOR #&01
560 STA toggle-offset
570 .tryital
580 LDA char-offset
590 CMP #&81
600 BNE tryascii
610 LDX #(ital-setup)
620 LDA toggle-offset
630 AND #&40
640 BEQ gotcode2
650 LDX #(nlq-setup)
660 .gotcode2
670 JSR outseq-offset
680 LDA toggle-offset
690 EOR #&C0
700 STA toggle-offset
710 .tryascii
720 LDA char-offset
730 CMP #&60
740 BNE notpound
750 LDX #(pound-setup)
760 JSR outseq-offset
770 JMP restore-offset
780 .notpound
790 LDA char-offset
800 CMP #&7E
810 BNE notexactspace
820 LDA #&20
830 STA char-offset
840 .notexactspace
850 LDA char-offset
860 BMI restore
870 LDA #&01
880 JSR oswrch
890 LDA char-offset
900 JSR oswrch
910 .restore
920 PLA
930 TAY
940 PLA
950 TAX
960 PLA
970 PLP
980 RTS
990 :
1000 .outseq
1010 LDA #&01
1020 JSR oswrch
1030 LDA setup-offset,X
1040 JSR oswrch
1050 INX
1060 LDA setup-offset,X
1070 BPL outseq
1080 RTS
1090 :
1100 .setup
1110 EQUB 27
1120 EQUB ASC "!"
1130 EQUB 0
1140 EQUB 27
1150 EQUB ASC "x"
1160 EQUB 1
1170 EQUB &FF
1180 .ulon
1190 EQUB 27
1200 EQUB ASC "-"
1210 EQUB 1
1220 EQUB &FF
1230 .uloff
1240 EQUB 27
1250 EQUB ASC "-"
1260 EQUB 0
1270 EQUB &FF
1280 .ital
1290 EQUB 27
1300 EQUB ASC "x"
1310 EQUB 0
1320 EQUB 27
1330 EQUB ASC "4"
1340 EQUB 27
1350 EQUB ASC "E"
1360 EQUB &FF
1370 .nlq
1380 EQUB 27
1390 EQUB ASC "5"
1400 EQUB 27
1410 EQUB ASC "F"
1420 EQUB 27
1430 EQUB ASC "x"
1440 EQUB 1
1450 EQUB &FF
1460 .pound
1470 EQUB 27
1480 EQUB ASC "R"
1490 EQUB 3
1500 EQUB 35
1510 EQUB 27
1520 EQUB ASC "R"
1530 EQUB 0
1540 EQUB &FF
1550 ] NEXT
1560 :
1570 sum%=0
1580 FOR I%=space TO P%
-1
1590 sum%=sum%+?I%
1600 NEXT
1610 IF sum%<>18857 THE
N PRINT "checksum error
- please check listing":
END
1620 :
1630 A$="*SAVE NLQ+It "
+STR$~space+"+100 40C 40
0"
1640 PRINT A$
1650 OSCLI A$
```

Listing 3. Preserve variables A

```
10 REM Preserve Variables A
20 REM By Jonathan Temple
30 REM for B/B+/E/M/C
40 REM (C) Acorn User December 1987
50 :
60 MODE 6
70 LOMEM=&5000
80 month$="December "
90 year=1987
100 PROCput
110 END
120 :
130 DEF PROCput
140 X%=!&2 AND &FFFF
150 FOR Y%=0 TO 125
160 Y%?X%=Y%?&482
170 NEXT
```

Continued ►

◄ Acorn Forum listing 3 continued

```
180 $&700="SAVE VARS "+STR$~LOMEM+" "+
STR$~(X%+126)
190 X%=&00
200 Y%=&07
210 CALL &FFF7
220 ENDPROC
```

Listing 4. Preserve variables B

```
10 REM Preserve Variables (B)
20 REM by Jonathan Temple
30 REM for B/B+/E/M/C
40 REM (C) Acorn User December 1987
50 :
60 MODE 6
```

Continued ►

◀ **Acorn Forum listing 4 continued**

```
 70 LOMEM=&5000
 80 $&700="LOAD VARS "+STR$~LOMEM
 90 X%=&00
100 Y%=&07
110 CALL &FFF7
120 X%=OPENIN "VARS"
```

Continued ▶

◀ **Acorn Forum listing 4 continued**

```
130 Y%=EXT# X%+LOMEM-126
140 CLOSE# X%
150 FOR X%=0 TO 125
160 X%?&482=X%?Y%
170 NEXT
180 :
190 PRINT''month$;year
```

Listing 5. Slow motion ROM image

```
   10 REM Slow motion RO
M image
   20 REM by Martin Hesk
eth
   30 REM for M/C only
   40 REM (C) Acorn User
 December 1987
   50 :
   60 title$="Slow motio
n Rom V1.0"
   70 copy$="(C)1987 Aco
rn User"
   80 handle$="4"
   90 osbyte=&FFF4
  100 oswrch=&FFEE
  110 :
  120 FOR pass=4 TO 7 ST
EP 3
  130 P%=&8000
  140 O%=&3000
  150 [OPT pass
  160 EQUB &4C
  170 EQUW &00
  180 EQUB &4C
  190 EQUW service
  200 EQUB 130
  210 EQUB (9+LEN title$
) MOD 256
  220 EQUB &00
  230 EQUS title$
  240 EQUB 0
  250 EQUS copy$
  260 EQUB 0
  270 :
  280 .service
  290 PHA
  300 PHX
  310 PHY
  320 CMP #&15
  330 BEQ pause1
  340 CMP #9
  350 BEQ help
  360 CMP #&27
  370 BEQ init
  380 .exit
  390 PLY
  400 PLX
  410 PLA
  420 RTS
  430 :
  440 .pause1
  450 JMP pause
  460 :
  470 .help
  480 JSR movecursor
  490 LDA #8
  500 STA &F6
  510 LDA #&80
  520 STA &F7
  530 JSR print
  540 JSR oswrch
  550 BRA exit
  560 :
  570 .print
  580 LDY #0
  590 .loop
  600 INY
  610 LDA (&F6),Y
  620 JSR oswrch
  630 CMP #0
  640 BNE loop
  650 .movecursor
  660 LDA #13
  670 JSR oswrch
  680 LDA #10
  690 JSR oswrch
  700 RTS
  710 :
  720 .init
  730 LDA #22
  740 LDX #1
  750 JSR osbyte
  760 LDA #2
  770 STA counter
  780 STZ status
  790 JMP exit
  800 :
  810 .pause
  820 PHY
  830 JMP testkeys
  840 .return
  850 PLY
  860 DEY
  870 TYA
  880 BNE exit
  890 DEC counter
  900 LDA counter
  910 BNE exit
  920 LDA #2
  930 STA counter
  940 LDA status
  950 BEQ exit
  960 LDY block
  970 LDX block+1
  980 .pauseloop
  990 NOP
 1000 NOP
 1010 NOP
 1020 NOP
 1030 NOP
 1040 DEX
 1050 STA block+1
 1060 TXA
 1070 CMP #255
 1080 BNE pauseloop
 1090 LDX block+1
 1100 DEY
 1110 TYA
 1120 CMP #255
 1130 BNE pauseloop
 1140 JMP exit
 1150 :
 1160 .testkeys
 1170 LDA #129
 1180 LDX #196
 1190 LDY #&FF
 1200 JSR osbyte
 1210 TXA
 1220 CMP #&FF
 1230 BEQ plus
 1240 LDA #129
 1250 LDX #197
 1260 LDY #&FF
 1270 JSR osbyte
 1280 TXA
 1290 CMP #&FF
 1300 BEQ minus
 1310 LDA #129
 1320 LDX #164
 1330 LDY #&FF
 1340 JSR osbyte
 1350 TXA
 1360 CMP #&FF
 1370 BEQ on
 1380 LDA #129
 1390 LDX #165
 1400 LDY #&FF
 1410 JSR osbyte
 1420 TXA
 1430 CMP #&FF
 1440 BEQ off
 1450 JMP return
 1460 :
 1470 .on
 1480 LDA #1
 1490 STA status
 1500 JSR flush
 1510 LDA #137
 1520 LDX #1
 1530 JSR osbyte
 1540 JMP return
 1550 :
 1560 .off
 1570 STZ status
 1580 JSR flush
 1590 LDA #137
 1600 LDX #0
 1610 JSR osbyte
 1620 JMP return
 1630 :
 1640 .plus
 1650 CLC
 1660 LDA block+1
 1670 ADC #4
 1680 STA block+1
 1690 CMP #1
 1700 BEQ plusret
 1710 INC block
 1720 LDA block
 1730 CMP #255
 1740 BEQ special
 1750 .plusret
 1760 JSR flush
 1770 JMP return
 1780 :
 1790 .minus
```

Continued ▶

JOE'S JOTTINGS

◄ Acorn Forum listing 5 continued

```
1800 SEC
1810 LDA block+1
1820 SBC #4
1830 CMP #255
1840 BEQ minusret
1850 DEC block
1860 LDA block
1870 CMP #255
1880 BEQ special1
1890 .minusret
1900 JSR flush
1910 JMP return
1920 :
1930 .special
1940 DEC block
1950 JSR flush
1960 JMP return
1970 :
1980 .special1
1990 INC block
2000 JSR flush
2010 JMP return
2020 :
2030 .flush
2040 LDA #145
2050 LDX #0
2060 JMP osbyte
2070 :
2080 .block
2090 EQUD &0100
2100 .counter
2110 EQUB &00
2120 .status
2130 EQUB &00
2140 ]
2150 NEXT pass
2160 :
2170 sum%=0
2180 FOR I%=&3000 TO O%
-1
2190 sum%=sum%+?I%
2200 NEXT
2210 IF sum%<>48561 THE
N PRINT"checksum error -
 please check listing":E
ND
2220 :
2230 A$="SRWRITE 3000 "
+STR$~(O%)+" 8000 "+hand
le$
2240 PRINT A$
2250 OSCLI A$
```

See Joe's Jottings, page 81

Listing 1. PCB design program

```
  10 REM CDT PCB Program
  20 REM by Joe Telford
  30 REM for B+/M/C
  40 REM (C) Acorn User Dec 1987
  50 :
  60 MODE 128
  70 PROCsetup
  80 ON ERROR PROCerr
  90 PROCpcursor
 100 REPEAT
 110 REPEAT
 120 *CLOSE
 130 PROCmove
 140 IF A%=68  PROCdraw(1,1):UNTIL 0
 150 IF A%=140 PROCdraw(2,1):UNTIL 0
 160 IF A%=150 PROCtext:UNTIL 0
 170 IF A%=84  PROCpad(1,1):UNTIL 0
 180 IF A%=141 PROCpad(2,1):UNTIL 0
 190 IF A%=142 PROCspecial:UNTIL 0
 200 IF A%=78  PROCdraw(1,0):UNTIL 0
 210 IF A%=143 PROCdraw(2,0):UNTIL 0
 220 IF A%=153 PROCeraseblock:UNTIL 0
 230 IF A%=79  PROCpad(1,0):UNTIL 0
 240 IF A%=144 PROCpad(2,0):UNTIL 0
 250 IF A%=154 PROCcls:UNTIL 0
 260 IF A%=77  PROCmark:UNTIL 0
 270 IF A%=145 PROCcopy:UNTIL 0
 280 IF A%=88  PROCswap(1):UNTIL 0
 290 IF A%=146 PROCswap(2):UNTIL 0
 300 IF A%=147 PROCload:UNTIL 0
 310 IF A%=157 PROCcat:UNTIL 0
 320 IF A%=148 PROCsave:UNTIL 0
 330 IF A%=158 PROCdelete:UNTIL 0
 340 IF A%=80  PROCdump:UNTIL 0
 350 UNTIL A%=149 OR A%=ASC"Q"
 360 UNTIL FNsure
 370 *FX 4,0
 380 *FX 12,0
 390 *FX 226,128
 400 *FX 227,144
 410 CLS
 420 END
 430 :
 440 DEF PROCcls
 450 PROCmess("Do you really want to lo
se this screen? (Y/N)")
 460 REPEAT A=(GET AND 223)
 470 UNTIL CHR$A="Y" OR CHR$(A)="N"
 480 PROCmess("")
 490 IF CHR$A="N":ENDPROC
 500 PROCpcursor
```

Continued ►

◄ Joe's Jottings listing 1 continued

```
 510 CLS
 520 PROCpcursor
 530 ENDPROC
 540 :
 550 DEF PROCcat
 560 PROCmess("WAIT!......CATALOGING FI
LES....")
 570 *PACK TEMP
 580 CLS
 590 *CAT
 600 PROCmess("Press SPACE to return to
 your diagram")
 610 REPEAT UNTIL GET=32
 620 *UNPACK TEMP
 630 PROCmess("")
 640 ENDPROC
 650 :
 660 DEF PROCload
 670 REPEAT
 680 PROCmess("Please type filename to
load (Return to CATALOGUE FILES): ")
 690 INPUT LINE "" f$
 700 IF f$="" THEN PROCcat
 710 PROCmess("")
 720 UNTIL f$>""
 730 ch%=OPENIN f$
 740 IF ch%=0 PROCnofile:ENDPROC
 750 CLOSE# ch%
 760 PROCmess("IF you are sure you want
 to load "+f$+": press SPACE")
 770 REPEAT UNTIL GET=32
 780 PROCpcursor
 790 OSCLI("UNPACK "+f$)
 800 PROCpcursor
 810 PROCmess("")
 820 ENDPROC
 830 :
 840 DEF PROCdelete
 850 REPEAT
 860 PROCmess("Please type filename to
delete (Return to CATALOGUE FILES): ")
 870 INPUT LINE "" f$
 880 IF f$="" PROCcat
 890 PROCmess("")
 900 UNTIL f$>""
 910 ch%=OPENIN f$
 920 IF ch%=0 PROCnofile:ENDPROC
 930 CLOSE# ch%
 940 PROCmess("IF you are sure you want
 to delete "+f$+": press SPACE")
```

Continued ►

◄ Joe's Jottings listing 1 continued

```
  950 REPEAT UNTIL GET=32
  960 OSCLI("DELETE "+f$)
  970 PROCmess("")
  980 ENDPROC
  990 :
 1000 DEF PROCnofile
 1010 PROCmess("That file doesn't exist
 - PRESS SPACE")
 1020 VDU 7
 1030 REPEAT UNTIL GET=32
 1040 PROCmess("")
 1050 ENDPROC
 1060 :
 1070 DEF PROCsave
 1080 REPEAT
 1090 PROCmess("Please type filename to
 save (Return for CAT): ")
 1100 INPUT LINE "" f$
 1110 IF f$="" THEN PROCcat
 1120 PROCmess("")
 1130 UNTIL f$>""
 1140 ch%=OPENIN f$
 1150 IF ch%<>0 THEN IF FNafile:ENDPROC
 1160 PRINT TAB(0,31);STRING$(79," ");
 1170 CLOSE# ch%
 1180 PROCpcursor
 1190 OSCLI("PACK "+f$)
 1200 PROCpcursor
 1210 ENDPROC
 1220 :
 1230 DEF FNafile
 1240 PROCmess("A file by that name exis
ts - SAVE (Y/N)")
 1250 REPEAT A=GET AND 223
 1260 UNTIL CHR$(A)="Y" OR CHR$(A)="N"
 1270 PROCmess("")
 1280 IF CHR$A="N" THEN=TRUE
 1290 =FALSE
 1300 :
 1310 DEF PROCtext
 1320 PROCmess("Please type the text: ")
 1330 INPUT LINE text$
 1340 len=LEN(text$)*16
 1350 GCOL 4,0
 1360 PROCrect(x%,y%,len,32,0)
 1370 cx%=x%
 1380 cy%=y%
 1390 PROCmess("Move the box then press
SPACE to fix it.")
 1400 REPEAT PROCmove
 1410 PROCrect(cx%,cy%,len,32,0)
 1420 PROCrect(x%,y%,len,32,0)
 1430 cx%=x%
 1440 cy%=y%
 1450 UNTIL A%=32
 1460 PROCrect(x%,y%,len,32,0)
 1470 MOVE x%,y%+32
 1480 VDU 5
 1490 PRINT text$
 1500 VDU 4
 1510 PROCmess("")
 1520 text$=""
 1530 ENDPROC
 1540 :
 1550 DEF PROCdraw(w%,d%)
 1560 IF w%=1 THEN line$=" THIN LINE: "
ELSE line$=" THICK LINE: "
 1570 IF d%=1 THEN line$="DRAW"+line$ EL
SE line$="ERASE"+line$
 1580 PROCmess(line$+" Move to start and
 press 'S'")
 1590 REPEAT PROCmove
 1600 UNTIL (A% AND 223)=ASC "S"
 1610 lx%=x%
```

Continued ►

◄ Joe's Jottings listing 1 continued

```
 1620 ly%=y%
 1630 PROCmess(line$+" Move to end and p
ress 'E'")
 1640 PROCmove
 1650 cx%=x%
 1660 cy%=y%
 1670 GCOL4,0
 1680 MOVE lx%,ly%
 1690 DRAW x%,y%
 1700 cx%=x%
 1710 cy%=y%
 1720 REPEAT
 1730 PROCmove
 1740 MOVE lx%,ly%
 1750 DRAW cx%,cy%
 1760 MOVE lx%,ly%
 1770 DRAW x%,y%
 1780 cx%=x%
 1790 cy%=y%
 1800 UNTIL(A% AND 223)=ASC"E"
 1810 PROCpcursor
 1820 PROCmess("")
 1830 GCOL 0,d%
 1840 IF w%=1 THEN PROCone ELSE PROCone:
PROCtwo
 1850 PROCpcursor
 1860 ENDPROC
 1870 :
 1880 DEF PROCeraseblock
 1890 PROCmark
 1900 PROCmess("Press SPACE to erase thi
s block")
 1910 A=GET
 1920 PROCmess("")
 1930 IF A<>32 ENDPROC
 1940 PROCpcursor
 1950 GCOL 0,0
 1960 PROCrect(bsx%,bsy%,bex%-bsx%,bey%-
bsy%,1)
 1970 PROCpcursor
 1980 ENDPROC
 1990 :
 2000 DEF PROCmark
 2010 PROCmess("MARK BLOCK: Move to star
t (bottom left) and press 'S'")
 2020 REPEAT PROCmove
 2030 UNTIL (A% AND 223)=ASC "S"
 2040 lx%=x%
 2050 ly%=y%
 2060 PROCmess("MARK BLOCK: Move to diag
onal (top rt) and press 'E'")
 2070 PROCmove
 2080 cx%=x%
 2090 cy%=y%
 2100 markflag%=1
 2110 GCOL 4,0
 2120 PROCrect(lx%,ly%,x%-lx%,y%-ly%,0)
 2130 cx%=x%
 2140 cy%=y%
 2150 REPEAT
 2160 PROCmove
 2170 PROCrect(lx%,ly%,cx%-lx%,cy%-ly%,0
)
 2180 PROCrect(lx%,ly%,x%-lx%,y%-ly%,0)
 2190 cx%=x%
 2200 cy%=y%
 2210 UNTIL(A% AND 223)=ASC"E"
 2220 PROCrect(lx%,ly%,cx%-lx%,cy%-ly%,0
)
 2230 bsx%=lx%
 2240 bsy%=ly%
 2250 bex%=x%
 2260 bey%=y%
 2270 PROCpcursor
```

Continued ►

◀ Joe's Jottings listing 1 continued

```
2280 y%=ly%
2290 x%=lx%
2300 PROCpcursor
2310 PROCmess("")
2320 IF bsx%>bex% THEN sp%=bsx%:bsx%=be
x%:bex%=sp%
2330 IF bsy%>bey% THEN sp%=bsy%:bsy%=be
y%:bey%=sp%
2340 markflag%=0
2350 ENDPROC
2360 :
2370 DEF PROCswap(x)
2380 PROCmark
2390 IF x=1 THEN mes$="HORIZONTAL SWAP:
" ELSE mes$="VERTICAL SWAP: "
2400 PROCmess(mes$+"Move to new bottom
left and press (M)ove or (C)opy")
2410 copyflag%=1
2420 GCOL 4,0
2430 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
2440 cx%=x%
2450 cy%=y%
2460 REPEAT
2470 PROCmove
2480 PROCrect(cx%,cy%,bex%-bsx%,bey%-bs
y%,0)
2490 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
2500 cx%=x%
2510 cy%=y%
2520 UNTIL (A% AND 223)=ASC "C" OR (A%
AND 223)=ASC "M"
2530 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
2540 IF ((x%+(bex%-bsx%))>xmax%) OR ((y
%+(bey%-bsy%))>ymax%) THEN PROCmess("WAR
NING:  some of the block will be off scr
een. ESCAPE or SPACE"):VDU7:REPEAT UNTIL
 GET=32
2550 PROCmess("")
2560 PROCpcursor
2570 MOVE bsx%,bsy%
2580 MOVE bex%,bey%
2590 IF (A% AND 223)=ASC"C" THEN MOVE b
sx%,bsy%:PLOT190,x%,y%:ELSE PLOT188,x%,y
%
2600 MOVE x%,y%
2610 copyflag%=0
2620 IF x=1 THEN PROCmess("Horizontally
 reflecting now......... Please wait"):E
LSE PROCmess("Vertically reflecting now.
..........Please wait")
2630 GCOL 0,1
2640 IF x=1 THEN PROCxswap ELSE PROCysw
ap
2650 PROCmess("")
2660 PROCpcursor
2670 ENDPROC
2680 :
2690 DEF PROCxswap
2700 xend%=x%+(bex%-bsx%)
2710 FOR row%=y% TO y%+bey%-bsy% STEP 4
2720 FOR column%=x% TO xend% STEP2
2730 sp=POINT(column%,row%)*2
2740 ps=POINT(x%+xend%-column%,row%)*2
2750 PLOT 71-ps,column%,row%
2760 PLOT 71-sp,x%+xend%-column%,row%
2770 IF column%>=(x%+xend%) DIV 2 THEN
column%=xend%
2780 NEXT
2790 NEXT
2800 ENDPROC
2810 :
```

Continued ▶

◀ Joe's Jottings listing 1 continued

```
2820 DEF PROCyswap
2830 yend%=y%+(bey%-bsy%)
2840 FOR column%=x% TO x%+bex%-bsx% STE
P 2
2850 FOR row%=y% TO yend% STEP 4
2860 sp=POINT(column%,row%)*2
2870 ps=POINT(column%,y%+yend%-row%)* 2
2880 PLOT 71-ps,column%,row%
2890 PLOT 71-sp,column%,y%+yend%-row%
2900 IF row%>=(y%+yend%) DIV 2 THEN row
%=yend%
2910 NEXT
2920 NEXT
2930 ENDPROC
2940 :
2950 DEF PROCcopy
2960 PROCmess("COPY BLOCK: Move to new
bottom left and press (C)opy or (M)ove")
2970 copyflag%=1
2980 GCOL 4,0
2990 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
3000 cx%=x%
3010 cy%=y%
3020 REPEAT
3030 PROCmove
3040 PROCrect(cx%,cy%,bex%-bsx%,bey%-bs
y%,0)
3050 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
3060 cx%=x%
3070 cy%=y%
3080 UNTIL ((A% AND 223)=ASC "C") OR ((
A% AND 223)=ASC "M")
3090 PROCrect(x%,y%,bex%-bsx%,bey%-bsy%
,0)
3100 IF ((x%+(bex%-bsx%))>xmax%) OR ((y
%+(bey%-bsy%))>ymax%) THEN PROCmess("WAR
NING:  some of the block will be off scr
een. ESCAPE or SPACE"):VDU7:REPEAT UNTIL
 GET=32
3110 PROCmess("")
3120 PROCpcursor
3130 MOVE bsx%,bsy%
3140 MOVE bex%,bey%
3150 IF (A% AND 223)=ASC"C" THEN MOVE b
sx%,bsy%:PLOT190,x%,y%:ELSE PLOT 188,x%,
y%
3160 MOVE x%,y%
3170 PROCpcursor
3180 copyflag%=0
3190 ENDPROC
3200 :
3210 DEF PROCone
3220 IF ly%>=y% THEN cy%=y%+4
3230 IF ly%<y%  THEN cy%=y%-4
3240 IF lx%>=x% THEN cx%=x%-4
3250 IF lx%<x%  THEN cx%=x%+4
3260 IF (ly%=y%) AND (lx%<>x%) THEN cy%
=y%+4:cx%=x%
3270 IF (lx%=x%) AND (ly%<>y%) THEN cx%
=x%-4:cy%=y%
3280 IF (lx%=x%) AND (ly%=y%)  THEN cx%
=x%:cy%=y%
3290 MOVE lx%,ly%
3300 MOVE x%,y%
3310 PLOT 117,cx%,cy%
3320 ENDPROC
3330 :
3340 DEF PROCtwo
3350 IF ly%>=y% THEN cy%=y%-4
3360 IF ly%<y%  THEN cy%=y%+4
3370 IF lx%>=x% THEN cx%=x%+4
```

Continued ▶

◀ Joe's Jottings listing 1 continued

```
3380 IF lx%<x%  THEN cx%=x%-4
3390 IF (ly%=y%) AND (lx%<>x%) THEN cy%
=y%-4:cx%=x%
3400 IF (lx%=x%) AND (ly%<>y%) THEN cx%
=x%+4:cy%=y%
3410 IF (lx%=x%) AND (ly%=y%)  THEN cx%
=x%:cy%=y%
3420 MOVE lx%,ly%
3430 MOVE x%,y%
3440 PLOT 117,cx%,cy%
3450 ENDPROC
3460 :
3470 DEF PROCspecial
3480 PROCmess("Code for shape: ")
3490 INPUT LINE "" shape$
3500 lx%=x%
3510 ly%=y%
3520 IF shape$="8PINV"  PROCsend(p8v$)
3530 IF shape$="14PINV" PROCsend(p14v$)
3540 IF shape$="16PINV" PROCsend(p16v$)
3550 IF shape$="28PINV" PROCsend(p28v$)
3560 IF shape$="8PINH"  PROCsend(p8h$)
3570 IF shape$="14PINH" PROCsend(p14h$)
3580 IF shape$="16PINH" PROCsend(p16h$)
3590 IF shape$="28PINH" PROCsend(p28h$)
3600 IF shape$="HOLE"   PROCsend(hole$)
3610 IF shape$="JOINL"  PROCsend(joinl$
)
3620 IF shape$="JOINS"  PROCsend(joins$
)
3630 ENDPROC
3640 :
3650 DEF PROCsend(s$)
3660 OSCLI("KEY 2 "+s$)
3670 *FX 138,0,130
3680 ENDPROC
3690 :
3700 DEF PROCpad(s%,d%)
3710 PROCpcursor
3720 GCOL 0,d%
3730 IF s%=1 PROCrect(x%-3,y%-3,9,9,1)
3740 IF s%=2 PROCrect(x%-7,y%-7,16,16,1
)
3750 GCOL 0,0
3760 PROCrect(x%,y%,3,3,1)
3770 PROCpcursor
3780 ENDPROC
3790 :
3800 DEF PROCerr
3810 PROCmess("")
3820 VDU 1,27,1,64,3
3830 VDU 29,24;108;
3840 IF markflag%=1 THEN GCOL 4,0:PROCr
ect(lx%,ly%,cx%-lx%,cy%-ly%,0):bsx%=bex%
:bsy%=bey%:markflag%=0
3850 IF copyflag%=1 THEN GCOL 4,0:PROCr
ect(x%,y%,bex%-bsx%,bey%-bsy%,0):copyfla
g%=0
3860 IF text$>"" THEN GCOL 4,0:PROCrect
(x%,y%,LEN(text$)*16,32,0):text$=""
3870 IF ERR=17 ENDPROC
3880 *FX 4,0
3890 REPORT:PRINT "at line ";ERL
3900 END
3910 :
3920 DEF PROCmess(T$)
3930 PRINT TAB(0,30);STRING$(80," ");
3940 PRINT TAB(0,30);T$;
3950 ENDPROC
3960 :
3970 DEF FNsure
3980 PROCmess("Do you really want to qu
it? (Y/N)")
```

Continued ▶

◀ Joe's Jottings listing 1 continued

```
3990 REPEAT A=(GET AND 223)
4000 UNTIL CHR$(A)="Y" OR CHR$(A)="N"
4010 IF CHR$(A)="Y" THEN =TRUE
4020 PROCmess("")
4030 =FALSE
4040 :
4050 DEF PROCpcursor
4060 GCOL 4,0
4070 MOVE x%+8,y%+8
4080 DRAW x%-8,y%-8
4090 MOVE x%+8,y%-8
4100 DRAW x%-8,y%+8
4110 MOVE x%,y%
4120 PRINT TAB(0,31)"Horizontal:";SPC(6
);
4130 PRINT TAB(0,31)"Horizontal: ";x%/1
60;CHR$34;
4140 PRINT TAB(18,31)"Vertical:";SPC(6)
;
4150 PRINT TAB(18,31)"Vertical: ";y%/16
0;CHR$34;
4160 ENDPROC
4170 :
4180 DEF PROCmove
4190 A%=GET
4200 gap%=16-144*INKEY-1
4210 gap%=gap%/((INKEY(-2)-1)*-1)
4220 GCOL 4,0
4230 PROCpcursor
4240 IF A%=137 PROCmovert
4250 IF A%=136 PROCmovelt
4260 IF A%=139 PROCmoveup
4270 IF A%=138 PROCmovedn
4280 GCOL 4,0
4290 PROCpcursor
4300 ENDPROC
4310 :
4320 DEF PROCmovert
4330 IF (x%+gap%)>xmax% THEN VDU 7:ENDP
ROC
4340 x%=x%+gap%
4350 ENDPROC
4360 :
4370 DEF PROCmovelt
4380 IF (x%-gap%)<0 THEN VDU 7:ENDPROC
4390 x%=x%-gap%
4400 ENDPROC
4410 :
4420 DEF PROCmovedn
4430 IF (y%-gap%)<0 THEN VDU 7:ENDPROC
4440 y%=y%-gap%
4450 ENDPROC
4460 :
4470 DEF PROCmoveup
4480 IF (y%+gap%)>ymax% THEN VDU 7:ENDP
ROC
4490 y%=y%+gap%
4500 ENDPROC
4510 :
4520 DEF PROCsetup
4530 xmax%=1232
4540 ymax%=892
4550 *FX 226,140
4560 *FX 227,150
4570 VDU 29,24;108;
4580 x%=0:y%=0
4590 lx%=0:ly%=0
4600 bsx%=0:bsy%=0
4610 bex%=0:bey%=0
4620 markflag%=0:copyflag%=0
4630 text$=""
4640 *FX 4,1
4650 *KEY 0 D
```

Continued ▶

◀ **Joe's Jottings listing 1 continued**

```
4660 *KEY 1 T
4670 *KEY 2 ""
4680 *KEY 3 N
4690 *KEY 4 O
4700 *KEY 5 M
4710 *KEY 6 X
4720 *KEY 7 P
4730 *KEY 8 P
4740 *KEY 9 Q
4750 l$=CHR$136
4760 r$=CHR$137
4770 u$=CHR$139
4780 d$=CHR$138
4790 pv$="T"+d$
4800 p16v$=STRING$(8,pv$)+STRING$(8,u$)
+r$+r$+r$+STRING$(8,pv$)+STRING$(8,u$)+l
$+l$+l$
4810 p14v$=STRING$(7,pv$)+STRING$(7,u$)
+r$+r$+r$+STRING$(7,pv$)+STRING$(7,u$)+l
$+l$+l$
4820 p8v$=STRING$(4,pv$)+STRING$(4,u$)+
r$+r$+r$+STRING$(4,pv$)+STRING$(4,u$)+l$
+l$+l$
4830 p28v$=STRING$(14,pv$)+STRING$(14,u
$)+r$+r$+r$+r$+r$+r$+STRING$(14,pv$)+STR
ING$(14,u$)+l$+l$+l$+l$+l$+l$
4840 ph$="T"+r$
4850 p16h$=STRING$(8,ph$)+STRING$(8,l$)
+u$+u$+u$+STRING$(8,ph$)+STRING$(8,l$)+d
$+d$+d$
4860 p14h$=STRING$(7,ph$)+STRING$(7,l$)
+u$+u$+u$+STRING$(7,ph$)+STRING$(7,l$)+d
$+d$+d$
4870 p8h$=STRING$(4,ph$)+STRING$(4,l$)+
u$+u$+u$+STRING$(4,ph$)+STRING$(4,l$)+d$
+d$+d$
4880 p28h$=STRING$(14,ph$)+STRING$(14,l
$)+u$+u$+u$+u$+u$+u$+STRING$(14,ph$)+STR
ING$(14,l$)+d$+d$+d$+d$+d$+d$
4890 hole$=u$+u$+"DS"+d$+d$+d$+d$+"E"+u
$+u$+l$+l$+"DS"+r$+r$+r$+r$+"E"+l$+l$+"T
"
4900 joins$="EDS"
4910 joinl$="E"+CHR$(140)+"S"
4920 ENDPROC
4930 :
4940 DEF PROCrect(x,y,l,w,f)
4950 MOVE x,y
4960 DRAW x+l,y
4970 IF f=0 THEN DRAW x+l,y+w ELSE PLOT
85,x,y+w
4980 IF f=0 THEN DRAW x,y+w ELSE PLOT 8
5,x+l,y+w
4990 MOVE x,y+w
5000 IF f=0 DRAW x,y ELSE MOVE x,y
5010 ENDPROC
5020 :
5030 DEF PROCdump
5040 PROCmess("Do you really want to pr
intout this design? (Y/N)")
5050 REPEAT A=(GET AND 223)
5060 UNTIL CHR$(A)="Y" OR CHR$(A)="N"
5070 IF CHR$(A)="N" PROCmess(""):ENDPRO
C
5080 PROCmess("PRESS SPACE WHEN READY!"
)
5090 REPEAT UNTIL GET=32
5100 PROCmess("")
5110 PRINT TAB(0,31)STRING$(79," ");
5120 PROCpcursor
5130 MOVE 0,0
5140 VDU 29,0;0;2
5150 VDU 1,27,1,51,1,1,1,10
```

Continued ▶

◀ **Joe's Jottings listing 1 continued**

```
5160 FOR Y%=1020 TO 12 STEP-16
5170 VDU 1,27,1,76,1,192,1,3
5180 FOR X%=0 TO 1276 STEP 4
5190 A%=0:B%=0
5200 FOR Z%=0 TO 12 STEP 4
5210 A%=A%*4+3*POINT(X%,Y%-Z%)
5220 B%=B%*4+3*POINT(X%+2,Y%-Z%)
5230 NEXT
5240 VDU 1,A% AND 254,1,A% AND 254,1,B%
AND 254
5250 NEXT
5260 VDU 1,27,1,76,1,192,1,3
5270 FOR X%=0 TO 1276 STEP 4
5280 A%=0:B%=0
5290 FOR Z%=0 TO 12 STEP 4
5300 A%=A%*4+3*POINT(X%,Y%-Z%)
5310 B%=B%*4+3*POINT(X%+2,Y%-Z%)
5320 NEXT
5330 VDU 1,A% AND 254,1,A% AND 254,1,B%
AND 254
5340 NEXT
5350 VDU 1,27,1,74,1,19,1,10
5360 NEXT
5370 VDU 1,27,1,64,3
5380 VDU 29,24;108;
5390 PROCpcursor
5400 ENDPROC
```

Listing 2. Packing program

```
10 REM Packing Program
20 REM by Joe Telford
30 REM for B+/M/C
40 REM (C) Acorn User Dec 1987
50 :
60 adrs=&70
70 ptrlochi=&F7
80 ptrloclow=&F6
90 bloc=&72
100 nloc=&73
110 handle=&74
120 openout=&80
130 osfind=&FFCE
140 osbput=&FFD4
150 osrdsc=&FFB9
160 osargs=&FFDA
170 gsinit=&FFC2
180 gsread=&FFC5
190 start%=&900
200 FOR pass=0 TO 3 STEP 3
210 P%=start%
220 [OPTpass
230 LDX #adrs
240 LDY #0
250 LDA #1
260 JSR osargs
270 LDA adrs
280 STA &F2
290 LDA adrs+1
300 STA &F3
310 LDY #0
320 CLC
330 .getchr
340 JSR gsinit
350 BEQ crash
360 JMP across
370 .crash
380 BRK
390 EQUB &80
400 EQUS "PACK <fname>"
410 BRK
420 .across
430 JSR gsread
```

Continued ▶

◀ Joe's Jottings listing 2 continued

```
440 BCS out
450 STA buffer-1,Y
460 JMP across
470 .out
480 INY
490 LDA #13
500 STA buffer-1,Y
510 LDY #buffer DIV 256
520 LDX #buffer MOD 256
530 LDA #openout
540 JSR osfind
550 CMP #0
560 BNE setup
570 BRK
580 EQUB &81
590 EQUS "Can't Pack that file!"+CHR$1
3
600 BRK
610 .setup
620 STA handle
630 LDA #&FF
640 STA ptrloclow
650 LDA #&2F
660 STA ptrlochi
670 .mainloop
680 CLC
690 JSR increment
700 STA bloc
710 LDA ptrlochi
720 CMP #&80
730 BEQ exit
740 LDA #0
750 STA nloc
760 .counter
770 INC nloc
780 JSR increment
790 CMP bloc
800 BNE endcount
810 LDA nloc
820 CMP #&FF
830 BNE counter
840 .endcount
850 DEC ptrloclow
860 LDA ptrloclow
870 CMP #&FF
880 BNE on
890 DEC ptrlochi
900 .on
910 LDA bloc
920 LDY handle
930 JSR osbput
940 LDA nloc
950 LDY handle
960 JSR osbput
970 JMP mainloop
980 .exit
990 LDY handle
1000 LDA #0
1010 JSR osfind
1020 RTS
1030 .increment
1040 INC ptrloclow
1050 BNE over
1060 INC ptrlochi
1070 .over
1080 LDY #0
1090 JSR osrdsc
1100 RTS
1110 .buffer
1120 ]
1130 NEXT
1140 :
1150 P%=0
1160 FOR I%=&900 TO &9BA
```

Continued ▶

◀ Joe's Jottings listing 2 continued

```
1170 P%=P%+?(I%)
1180 NEXT I%
1190 IF P%<>23317 PRINT "Error in progr
am - Please check listing":END
1200 :
1210 PRINT "Press <SPACE> to save code.
"
1220 REPEAT UNTIL GET=32
1230 *SAVE PACK FFFF0900+100
```

Listing 3. Unpacking program

```
10 REM UnPacking Program
20 REM by Joe Telford
30 REM for B+/M/C
40 REM (C) Acorn User Dec 1987
50 :
60 adrs=&70
70 ptrlochi=&D7
80 ptrloclow=&D6
90 bloc=&72
100 nloc=&73
110 handle=&74
120 openin=&40
130 osfind=&FFCE
140 osbget=&FFD7
150 oswrsc=&FFB3
160 osargs=&FFDA
170 gsinit=&FFC2
180 gsread=&FFC5
190 start%=&900
200 FOR pass=0 TO 3 STEP 3
210 P%=start%
220 [OPT pass
230 LDX #adrs
240 LDY #0
250 LDA #1
260 JSR osargs
270 LDA adrs
280 STA &F2
290 LDA adrs+1
300 STA &F3
310 LDY #0
320 CLC
330 .getchr
340 JSR gsinit
350 BEQ crash
360 JMP across
370 .crash
380 BRK
390 EQUB &82
400 EQUS "UNPACK <fname>"
410 BRK
420 .across
430 JSR gsread
440 BCS out
450 STA buffer-1,Y
460 JMP across
470 .out
480 INY
490 LDA #13
500 STA buffer-1,Y
510 LDY #buffer DIV 256
520 LDX #buffer MOD 256
530 LDA #openin
540 JSR osfind
550 CMP #0
560 BNE setup
570 BRK
580 EQUB &83
590 EQUS "Can't find that file!"+CHR$1
3
```

Continued ▶

◀ **Joe's Jottings listing 3 continued**

```
600 BRK
610 .setup
620 STA handle
630 LDA #&FF
640 STA ptrloclow
650 LDA #&2F
660 STA ptrlochi
670 .getchars
680 CLC
690 LDY handle
700 JSR osbget
710 STA bloc
720 BCS exit
730 LDY handle
740 JSR osbget
750 STA nloc
760 BCS exit
770 .loop
780 INC ptrloclow
790 BNE over
800 INC ptrlochi
810 .over
820 LDY #0
830 LDA bloc
840 JSR oswrsc
850 DEC nloc
860 BNE loop
870 BEQ getchars
880 .exit
890 LDY handle
900 LDA #0
910 JSR osfind
920 RTS
930 .buffer
940 ]
950 NEXT
960 :
970 P%=0
980 FOR I%=&900 TO &9CC
990 P%=P%+?I%
1000 NEXT I%
1010 IF P%<>24673 PRINT "Error is program - Please check listing":END
1020 :
1030 PRINT "Press <SPACE> to save code."
1040 REPEAT UNTIL GET=32
1050 *SAVE UNPACK FFFF0900+100
```

Pretty as a Picture, page 87

Listing 1. Plotter screen dump

```
10 REM Plotter Pointillism
20 REM by John Downie
30 REM for BBC B/B+/M/C
40 REM (c) Acorn User December 1987
50 :
60 ON ERROR PROCerror
70 plotterscale=1.7:dither%=3
80 hrzstep=8:vertstep=8
90 mode%=2
100 style%=1:side=8
110 picfil$="PICFILE"
120 MODE mode%
130 OSCLI("LOAD "+picfil$+" 3000")
140 FOR colour%=0 TO 7
150 pen%=colour%
160 PROCpenselect(pen%)
170 R%=8*dither%
180 f=side
190 blx=0:bly=0:trx=1279:try=1023
200 direction%=TRUE
210 UP%=TRUE
```

Continued ▶

◀ **Pretty as a Picture listing 1 continued**

```
220 Y%=bly
230 REPEAT
240 IF direction%=TRUE THEN start%=blx:end%=trx:step=hrzstep:direction%=FALSE ELSE start%=trx:end%=blx:step=-hrzstep:direction%=TRUE
250 X%=start%
260 stpcr%=FALSE
270 REPEAT
280 IF POINT(X%,Y%)=colour% THEN PROCpldot(X%,Y%)
290 X%=X%+step
300 IF step>0 AND X%>=end% THEN stpcr%=TRUE
310 IF step<0 AND X%<=end% THEN stpcr%=TRUE
320 UNTIL stpcr%
330 Y%=Y%+vertstep
340 UNTIL Y%>=try
350 first%=FALSE
360 NEXT colour%
370 END
380 :
390 DEF PROCpldot(x%,y%)
400 LOCAL X%,Y%
410 *FX 3,10
420 X%=INT(plotterscale*x%)+RND(R%)
430 Y%=INT(plotterscale*y%)+RND(R%)
440 PRINT "M";STR$(X%)","STR$(Y%)
450 ON style% GOTO 460,470,480
460 PROCdot:ENDPROC
470 PROCsquare:ENDPROC
480 PROCline:ENDPROC
490 :
500 DEF PROCpenselect(index%)
510 penum%=pen%
520 IF penum%=0 ENDPROC
530 *FX 3,10
540 PRINT "J";STR$(penum%)
550 *FX 3
560 ENDPROC
570 :
580 DEF PROCsquare
590 PROCpenplot(f,0):PROCpenplot(f,f)
600 PROCpenplot(0,f):PROCpenplot(0,0)
610 PROCup
620 *FX 3
630 ENDPROC
640 :
650 DEF PROCline
660 PROCpenplot(2*RND(f)-f,2*RND(f)-f)
670 PROCup
680 *FX 3
690 ENDPROC
700 :
710 DEF PROCdot
720 PROCpenplot(0,0)
730 PROCup
740 *FX 3
750 ENDPROC
760 :
770 DEF PROCpenplot(x%,y%)
780 *FX 3,10
790 PRINT"D";STR$(X%+x%)","STR$(Y%+y%)
800 ENDPROC
810 :
820 DEF PROCup
830 PRINT "M";STR$(X%)","STR$(Y%)
840 ENDPROC
850 :
860 DEF PROCerror
870 *FX 3
880 CLS
890 REPORT:PRINT" at line ";ERL
900 END
```

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☐ SEP 0028-0	☐ AUG 0039-6	☐ SEP 0052-3
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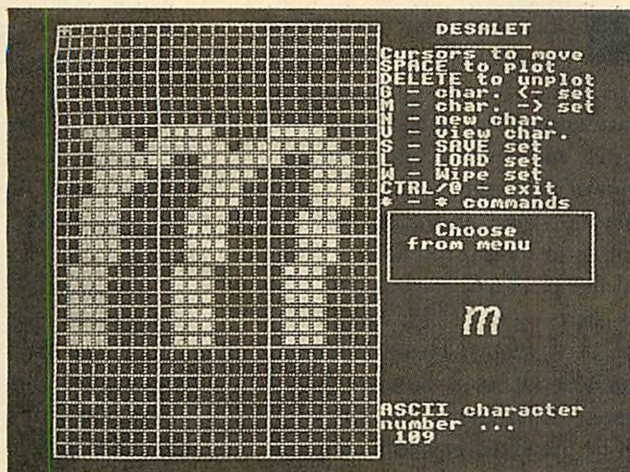
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OFFERS

C A L L I G R A P H Y



A new dimension in letter designing

BBC/B/B+/M This is your chance to produce your own letterheads and posters to a professional standard, with the minimum of fuss and effort. *Acorn User*'s *Calligraphy* disc has been compiled due to popular demand and contains all the programs needed to produce letter designs that will impress your friends and colleagues.

The *Desalet* program is a simple font creator which produces customised letters, to your personal design. It will save you from using repetitive data statements and error prone calculations. You can save your font set on disc and then call it up as needed. All previously saved sets can be modified or added to, and each set covers up to 94 characters.

Modical, a modification of the original *Calligraphy* program (September 1986 *Acorn User*) is also included on the disc. *Modical* allows the use of disc-based font sets created with *Desalet*. *Modical* also incorporates a modified file creation program, which permits files to be printed out immediately or saved for later printing.

An enhanced font ROM in the form of a sideways RAM image, is also on the disc. This allows you to design your own fonts for use on-screen. Any output to the printer will be in the new font – thus giving true WYSIWYG capabilities. There is a selection of new fonts to help you get started.

This superb disc comes in 5.25-inch, 40/80-track format and is great value at only £9.95.

L I S T I N G S

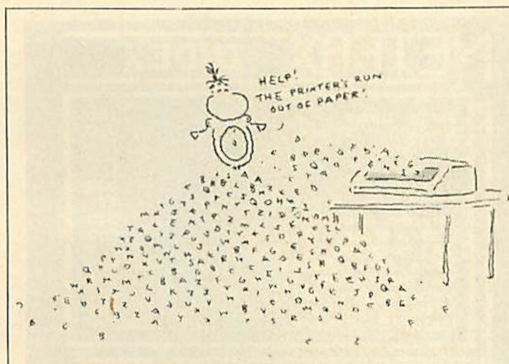


Easy learning with Education disc

BBC/B/B+/M/C The *Acorn User* Education disc makes learning easy and enjoyable. The disc is packed with useful programs, including the *Eco-fax* database for Econets.

Graphics are a strong feature, and included on the disc are *Turtle Logo*, *Easyplot* and *Bulletin*, and you can then show off your creations with *Vufoil* and *Noticeboard* or make music with *Tunemaker*. Also included are an all-mode dumping routine for Epson compatibles and a teletext dumping routine for mode 7 dumping to Epson FX80 compatibles. All this for only £7.95.

D I S C S



Printer advice with Printer Help disc

BBC/B/B+/M/C Often printer manuals don't fully cover the Master and BBC micro – our disc will help you to understand your printer's facilities for just £7.95.

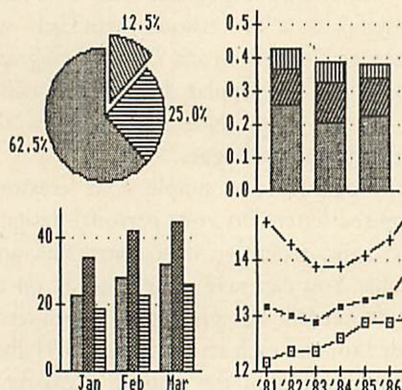
The 5.25-inch *Printer Help* disc illustrates various print type styles, use of *Wordwise* and *View*, screen images and printer care. There is an ASCII standard codes table and clear diagrams illustrating stages of printer use including advice on what to do if things go wrong.

For compatibility details write to Seran, Redwood Publishing Ltd, 20-26 Brunswick Place, London N1 6DJ.

Acorn User order form on page 130 – 24 hour telephone service (0672) 40825

OFFERS

CHART SOFTWARE



Improve your presentation with ViewChart

BBC/B/B+/M/C Do you use your micro to prepare figures? Perhaps in *ViewSheet* or *ViewStore*? Do you make printed reports? This business graphics program from *Acorn User* contributor Peter Sandford is aimed at anyone who uses figures, and wishes to improve the quality of their work.

ViewChart takes your numeric data from a *ViewSheet* or *ViewStore* file, or manual input, and plots various chart formats to screen. In one plot you can produce between one and five piecharts, stacked bar charts up to 25 bars, grouped bar charts up to 24 bars and line graphs with up to five lines each of 40 plotted points.

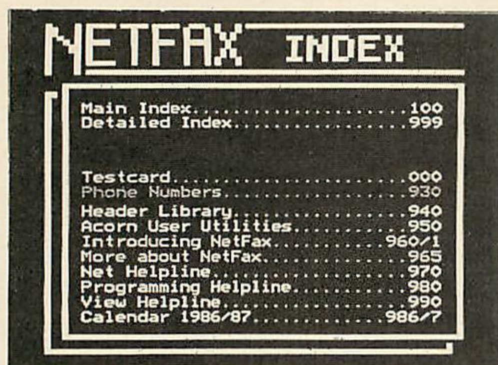
In practice, most business presentation data such as sales figures, departmental breakdowns, cost analyses and so on can be presented in a form even the boss will understand!

You can even add extra text and graphics to the completed chart prior to saving or printing. A screen dump program is provided, for Epson and compatible printers, which is specifically designed to fit the width of an A4 page. Instructions are provided on interfacing to other printers. *ViewChart* works in screen mode 0, using full shading effects, so what you see on screen is what you get on paper, and includes some tips on final presentation of graphics in documents.

ViewChart is supplied on 40-track 5.25-inch disc and works on the BBC models B and B+ and Master 128.

And the price of this professional software? Just £12.95.

DISCS



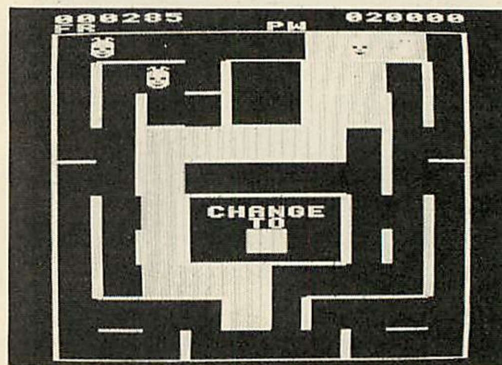
Network utilities for better communication

BBC/B/B+/M/C The *Network Utilities* 80-track disc is the logical addition to your network, combining invaluable routines with a sophisticated yet easy-to-use noticeboard.

Included is *Netfax*, our own hybrid information system providing access to thousands of pages of information. Other special features are: a file locator and directory size finder; network manager utilities including a bridge compatible screen viewer and a 'notify all' facility.

Plus there are 150 *Netfax* pages covering instructions, help and indexes, all on a 5.25-inch disc for £19.95.

CASSETTES



Games galore in our compendium cassette

BBC/B/B+/M/E You can guide Shuggy around his garden; puzzle over *Puzzle*, and be *3-D* amazed. Or destroy submarines with *Run Silent, Run Deep*. And for the really adventurous, go round the *Acorn User* office.

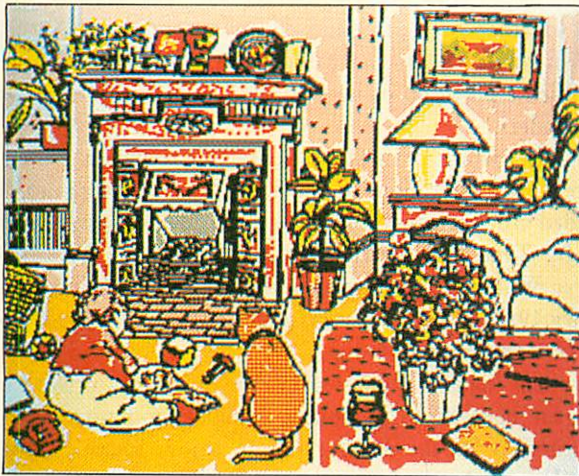
Best of all, try the truly different *Adventure* game written especially for the *Games Compendium* cassette by Rob Anderson. It's excellent value at £3.95.

You will also find David Acton's *Spectramania* and *Quadline* on this cassette: beat your micro, get four in a row. All are easily transferred to disc.

Acorn User order form on page 130 – 24 hour telephone service (0672) 40825

OFFERS

PROGRAM LISTINGS



This month's graphics special listings disc

Joe Telford has devised a program to design printed circuit boards on screen, and he provides a metronome circuit as an example of what you can do with it. Meanwhile Tessie Revivis shows all First Byters how to use filing systems directly from machine code.

John Downey has written software for computer artist Karl Torok, whose distinctive work harks back to the pointillist style of Seurat, as the basis of his screen dumping routine for output to plotters.

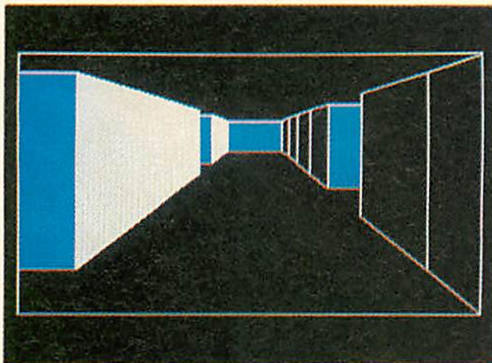
Forum for December includes an ADFS broken directory fixer by Steven Oxley – a guaranteed life saver, a *View* printer driver which allows the use of both NLQ and italic styles by Stuart Rogers; there is also an extended *FIND command allowing the use of a wild card. Jonathan Temple has provided a routine for preserving variables between programs and for all Master owners Martin Hesketh has put together a 'slow motion' ROM.

For this special graphics issue we have included a number of the remarkable drawings featured in the magazine as the month's Graphics Bonus.

December's listings are available in 5.25-inch 40/80-track disc for the BBC and Master 128 and on cassette for Electron and BBC micro users.

For our special £49 Christmas disc subscription offer please turn to page 52.

LISTINGS



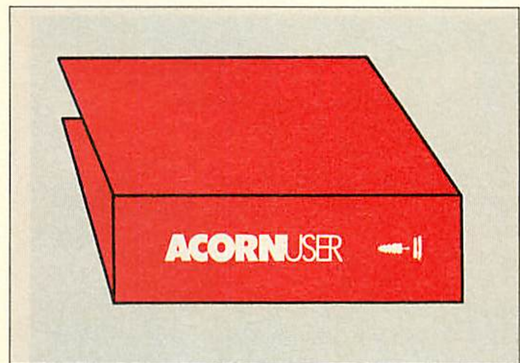
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Save up to £29 this Christmas by giving a monthly listings subscription as a gift. Every *Acorn User* monthly listings cassette or disc is packed with the very best programs, graphics and utilities.

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But hurry we must have your order by January 31 1988! The offer is open to UK subscribers only.

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OFFERS

P O R T F O L I O   D I S C S



A Portfolio of micro masterpieces

BBC/B/ B+/M Jonathan Inglis, freelance illustrator and Acorn's artist-in-residence for the launch of the Master series, has assembled a portfolio of his best work exclusively for *Acorn User* readers.

The disc, which costs £9.95, contains screens that national and regional publications have commissioned Jonathan to do. Included are representations of Seurat's 'Bathers', which was used by *Time Out* for a cover, and two *Acorn User* front covers; Willow from November 1986 and Magician from January 1986, as well as several which were commissioned by *The Times* newspaper group.

Jonathan Inglis is interested in the conversion of work by the great master's to computer graphics, and three of his favourites are on the disc for you to enjoy: Seurat's 'Riverside', Vermeer's 'Lady at the Virginal' and a copy of a lithograph by Matisse.

Pixel Editor and *Super Painter* have been incorporated to let you create your own masterpieces. *Pixel Editor* allows you draw in and alter the minute detail while *Super Painter* enables you to draw lines, texture your screen and shade by mixing the eight standard colours.

The *Portfolio* disc comes in 80-track 5.25-inch format, and makes the ideal Christmas gift for the graphics fan. Enclosed with the disc is a comprehensive instruction sheet telling you more about the pictures and how the artist created them.

D I S C S



Disc for all sideways RAM users

BBC/B/ B+/M/ C The *Sideways RAM Utilities* disc includes: *Ram-Pad* – your computer's answer to the pad and pen. *On-Screen Fonts* – a variety of print styles available in all graphics modes. * HLP ROM – add your own help text to call up when you're stuck. Standard ROM header for use when writing your own ROMs. * RLOOK to examine the contents of your ROMs and sideways RAM images.

There are many more utilities on this 40-track 5.25-inch disc with a transfer program for 80-track users, and it's competitively priced at £9.95.

D I S C S



Graphics utilities for your screens

BBC/B/ B+/M/ C The 40-track 5.25-inch *Graphics Utilities* disc, keenly priced at £7.95, features 16 routines to manipulate blocks of graphics: rotation and reflection, a screen compressor/expander, a colour flood-fill routine and three mode conversion commands.

With the Basic procedure library are multi-height, proportional and justified text and 'drop shadow' boxes. A teletext screen editor gives point plotting, line drawing, rubber banding and flood fill, along with all mode 7 control codes. All can be used in your own programs.

Acorn User order form on page 130 – 24 hour telephone service (0672) 40825

D U M P R O M S



Printer control with the UserDump ROM

BBC/B/ B+/M/ C/E This pack includes the easy-to-fit *UserDump* ROM chip and a practical 22-page guide to the screen dump and printer control facilities offered – for just £19.95.

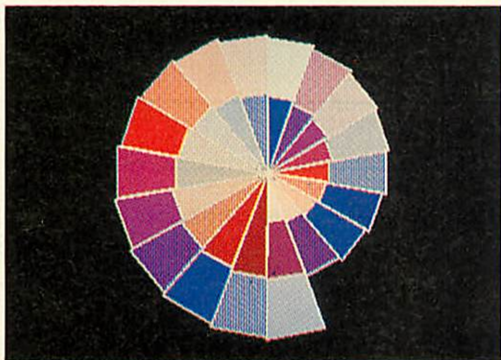
Once installed, *UserDump* will allow you to dump any screen image in any display mode by entering a single command – either as a line of your program or by typing in direct from the keyboard. A perfect dump can also be obtained while a machine code program is running.

UserDump features the following extra commands: *WDUMP – dump of graphics window only in any mode; *ZDUMP – a distortion-free dump of the mode 0 screen using plotter graphics; *TRANSIT – translate teletext screen into mode 1; *SHIFT ‹argument› – shift any area of memory; *IBM – select IBM printer; *CP80 – select CP80 printer.

UserDump is compatible with the BBC micro (model B or B+) fitted with operating system 1.2. Any earlier version will cause problems. *UserDump* is fully compatible with the Acorn 6502 second processor. It works with any printer which has single density and double density bit image graphics, including all Epson (LX, RX and FX) printers, Star Gemini and Delta, SG, SD and SR, Canon and Kaga NLQ. Also usable are the Shinwa and other CP80 printers.

There are many more commands available with *UserDump*, and details are available from Seran, Redwood Publishing Ltd., 20-26 Brunswick Place, London N1 6DJ.

R O M S

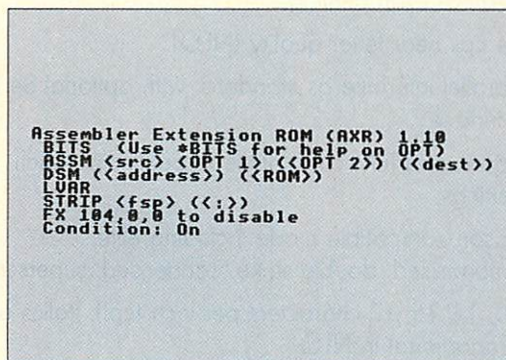


Your favourite Acorn User routines

BBC/B/ B+/M/ C/E Get *UserROM* for your favourite *Acorn User* routines. Plug in the ROM chip and 19 routines are instantly accessible via star commands, including colfill with 27 colourful fills; dotfill providing 23 new black and white shades; bad program recovery; variable lister; function key lister; a graphics compiler; a circle drawing routine and a sound compiler. There are many demonstration programs and a 22 page manual. All for £19.95.

Full details are available from Seran, Redwood Publishing Ltd., 20-26 Brunswick Place, London N1 6DJ.

R O M S



Acorn User Assembler Extension ROM

BBC/B/ B+/M The *AXR* ROM, competitively priced at £19.95, is especially designed for use by machine code programmers. *AXR* adds a variety of options and commands to the Basic assembler, along with several new pseudo op codes, full Basic expression evaluation, and even the use of binary numbers. A disassembler is included in the software, and all 65C02 instructions can be used. *AXR* is compatible with Basic 1, 2 and Master.

Further details from Seran, Redwood Publishing Ltd., 20-26 Brunswick Place, London N1 6DJ.

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Delivery on all printers is free. Ring for a sample printout, specification and the latest prices.

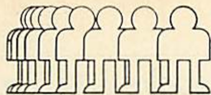
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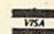
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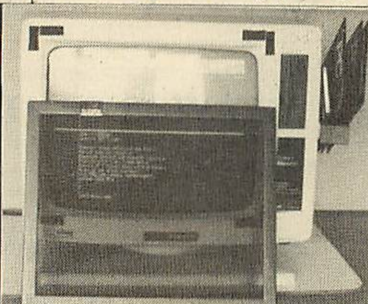


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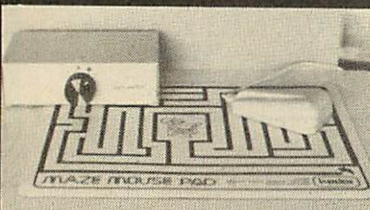


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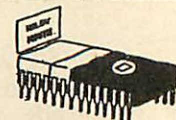
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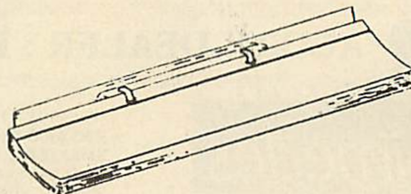
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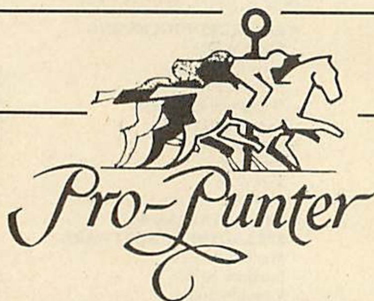
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REVIEWS

GAMES

THE GAMES PAGE

David Lawrences tries out winter sports, crushing bones and grappling with aliens

Next month's Games Page will be slightly different; I will be presenting my top games of the year. So, as there will be no games news next month, here's all you need to know about the Christmas releases.

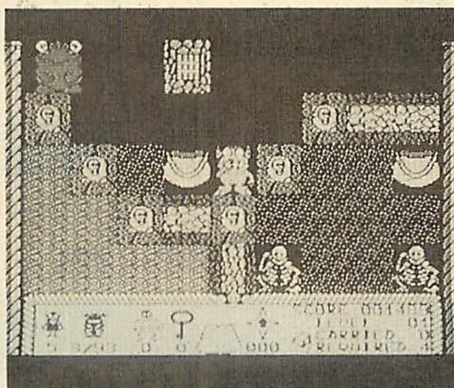
Tynesoft has two sports simulations planned for release before the end of the year. *Indosports* has been mentioned before, but *Winter Olympics II* has jumped 86 and is now called *Winter Olympics 88*. Tynesoft claims that 'this is the best sports simulation ever'. The game features six events: ski slalom, ski jump, giant slalom, three-man bob, speed skating and biathlon. Each event features large sprites and better ways of controlling the action than just pumping Z and X. Tynesoft, at least, must think that the game is good, as it is offering a trip to Calgary to see next year's real Winter Olympics as a prize!

The news from Audiogenic is that the near-mythical *Daxis* game has been passed from Gary Partis to Peter Scott for revision and finishing off. A version of *Impact* has arrived and it appears to be similar to *Arkanoid*. The consensus in the office is that the graphics of Peter Johnson's version, reviewed in October, are better.

November is going to be a busy month for Superior – it is planning three new releases. *The Life of Repton* and *Elixir* were reported last month, but the third, *Spellbinder*, was touched on only briefly.

Spellbinder has been written by two new BBC authors, Dan and Etan Shirron. It is very much in Ultimate *Knight Lore* vein, with isometric views of three-dimensional rooms. The story behind the game is fairly simple; one of the 10 original 'Magelords' has deserted, killed one of the other Magelords and hidden in a large castle. The remaining Magelords have voted to find the best qualified among them to hunt out the absconder.

This is, of course, you. It's no easy job, as the castle has been overrun by monsters, such as the 'Gramofoot' – very Monty Python. To aid you in the quest you can cast spells, but you need the correct ingredients to concoct the spells in the first place. So off you must go in search of leg of toad, eye of bat and so on. There are clues along the way in the form of bookcases and walldwarfs (?), but most of the way, you'll have to rely on your magical intuition. The castle is spread over two floors, with seven annexes and features over 100 rooms.



***Bonecrusher*: a soap making adventure!**

In December, watch out for *Bonecruncher*. This is not, as many thought, a boxing simulation, but an entrepreneurial exercise in soap selling! You are Bono the dragon, and with the aid of your friend Golen, you must make soap and deliver it to the bathing monsters. The bone crunching bit comes in because you must collect skeletons and crush them up to make the soap. But there are too few skeletons on each level, so you must suffocate some of the smaller monsters. This is done with the help of the 'hairy' monsters!

All this takes place on a *Repton*-like four-way scrolling playing area. There are 24 graded levels in total, loaded in three sets of eight. Other features in the game include spiders, staircases, doors and a black hole.

This is actually a conversion from a Commodore 64 game. The original is also being released by Superior. *Bonecruncher* is the second game from *Palace of Magic* author, Martyn Howard.

The only other new releases I've seen recently are, in fact, adventures, which is nice considering I've hardly seen any new ones this year. The first comes from Robico, of *The Rick Hanson Trilogy* fame. The new game, *The Hunt* is a fairly easy science-fiction adventure with all of the locations graphically depicted. As well as the tape and disc versions there is a special Master implementation.

The other release comes from Incentive Software and is actually two adventures on one tape. They are both graphical adventures, although I don't know how many locations are illustrated. The first is called *The Alien from Outer Space* and is strongly based on the science-fiction/horror film, *The Thing*. The other is called *Dragon's Tooth*, a fantasy with dragons, elves, wizards and magic swords. The tapes cost £7.95, which is good value for money.

Well, that's it for news for a couple of months; watch out for 'The Games of 1987' next time.

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GAMES

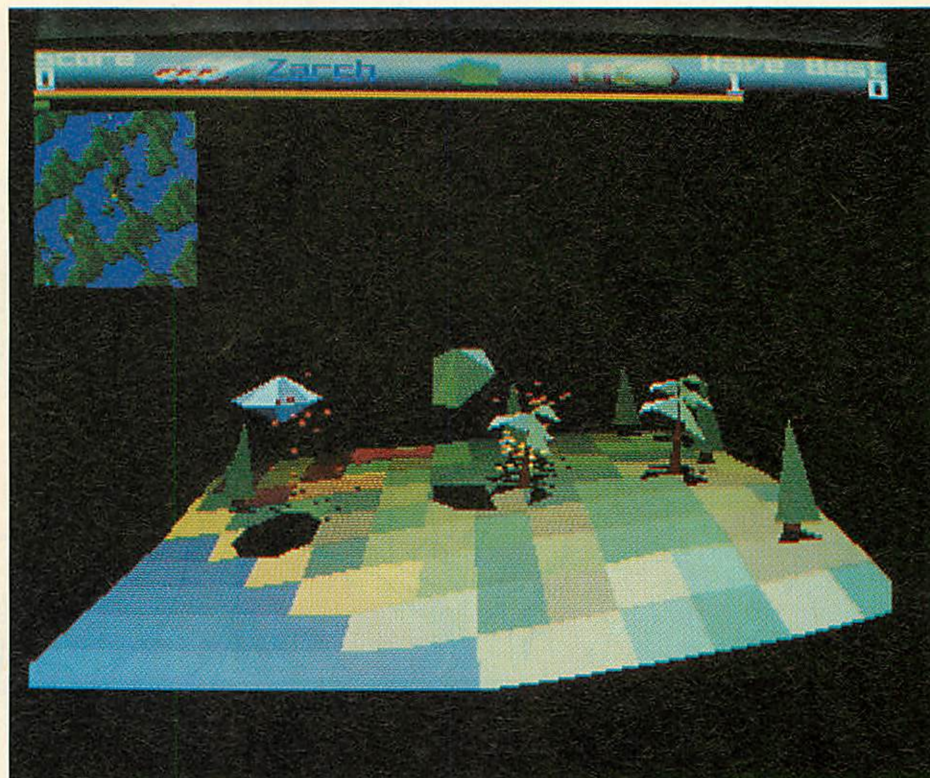
ZARCH HAS LANDED

When *Zarch*, the much heralded Archimedes game, arrived in the office, Sam Greenhill won the battle to be the first to try it out

Lander was the game supplied with the Archimedes. It was acclaimed as a revolution in software. Now Superior Software has released the full version – *Zarch*.

Both *Zarch* and *Lander* were written by Elite's co-author David Braben, but *Lander* includes only the basic features of the game. *Zarch* still has the three-dimensional scrolling landscape which *Lander* uses, but has other features such as an enemy, homing missiles and smart bombs.

At the start of the game you are provided with your *Zarch* hovercraft equipped with three homing missiles, two smart bombs, and a laser-cannon. The general objective of the game is to destroy the enemy craft, who are contaminating the landscape with a deadly red virus. In flying saucers called 'seeders' they patrol the land spraying out the virus which gently floats down and turns the land red. Another alien spacecraft, called a bomber, cruises along dropping small bombs in the form of parachutes, which sway as they fall, but explode spreading the red virus in all directions on impact.



***Zarch*: Attacking a marauding seeder as it spreads the deadly virus**

Blasting these out of the sky would not be difficult if it wasn't for various alien craft that attempt to shorten your life. These come in all shapes and forms, and vary according to the current level. They also have unoriginal names such as mutant, drone and bomber. They either take a kamikaze role, or simply fire using a gun similar to your own. One, the pest, is a particularly annoying device.

Zarch's graphics greatly resemble those of *Lander*, as one might expect, but with some nice extra touches like stars and rotating shrapnel during explosions. It also incorporates sound – explosions, firing and so on. Unlike *Lander*, shooting trees and houses does nothing to aid your score; you get points solely through the destruction of enemy aircraft. You gain an extra smart bomb and life after every 5000 points, but there are no extra missiles.

Along the top of the screen is a panel which indicates your hovercraft's current condition. It shows spare lives, missiles, smart bombs, your score and the high score plus fuel level and altitude.

Zarch also has a map, something that *Lander* lacked, which is constantly updated by radar scanners around the landscape. If one of these is accidentally destroyed, the area on the map that the scanner covered is replaced by a black square in which nothing is picked up. The map, which has two states, normal or zoom, shows up your hovercraft, the launch pad, the alien squadron and the landscape which is filled-in red where it is infected.

After my first game, I had scored −45, and was informed a fossilised snail could have done better, but the highest high score ranked only as 'acceptable'.

The demonstration mode starts off in a similar way to *Elite*, with the *Zarch* hovership rapidly spinning, but then goes on to play the game. It's not the same as a normal demo, where somebody has played the game and the computer recorded the movements. This one actually plays the game differently each time, thinking about reactions. It decides how to manoeuvre and when to fire, which I find fascinating.

Zarch handles in exactly the same way as *Lander*, which will allow players to get some practice in on *Zarch*'s predecessor before graduating to the game itself. The fire and thrust buttons remain the same but the hover is replaced by a smart bomb.

Once again David Braben has created a classic. *Zarch* collects top marks from me; I cannot find a single thing to criticise. Its performance is outstanding, and the graphics are stunning. The only question is whether there will be a market for Arc games in general. The people who are likely to buy the Archimedes may not be the sort that are going to want to spend large sums of money on games. Having seen it and played it, I strongly recommended it to anybody who possesses an Archimedes, as *Zarch* is remarkable.

Zarch; £19.95; Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX.

REVIEWS

GAMES

BOWLED OVER



Graham Gooch's Test Cricket; Audiogenic; BBC micro; £9.95 (on disc), £11.95 (on cassette)

After numerous attempts at athletics and a few feeble excuses for football games (*Matchday* is an honourable exception), the latest sporty game for the BBC micro comes from Audiogenic, under the title *Graham Gooch's Test Cricket.*

Test Cricket is packaged in a smart plastic wallet with clear instructions and some tips for playing the games. After loading you are asked to select your team from a list of famous, and nearly famous, cricketers. This is done before you select the number of players, so if you are on your own you have to choose your opponent's team as well.

Once your teams have been chosen, you have to decide between a limited overs match, where each side bowls a stated number of overs, or a full two-innings test match. The latter can last for over three hours, and without the option to save an uncompleted game, this is a very long time!

You are also asked if you wish to play in arcade or simulation mode; if you merely enjoy watching cricket then the latter is for you. If, however, you prefer to get a little more involved with the game then try arcade mode, where each player has to bat and bowl – this is very tricky and needs some careful practice.

All input can be joystick controlled, except when picking teams through a series of menus with a moving cursor. This is very frustrating if you don't happen to be using a joystick.

Overall, an original addition to anyone's software library. But with its little niggling problems – for example, unimaginative bleeps where sound envelopes could easily have been used – not one that I'll be spending my Sundays playing!

Richard Bellis

SHAKEN NOT STIRRED

The Living Daylights; Domark; BBC micro; £12.95 (disc), £9.95 (cassette)

The packaging claims that the *The Living Daylights* is closely based on the film. I haven't seen the film, but I don't think it would add anything if I had!

The Living Daylights is a sort of *Commando/Green Beret* clone featuring eight sideways-scrolling levels and enemies of various flavours. The idea is fairly simple; help 007 battle through the levels with his trusty Walther PPK before confronting his arch enemy, Brad Whittaker, and winning the favour of the beautiful Czechoslovak cellist, Kara (she's only mentioned on the packaging).

The eight levels are meant to represent different international locations, ranging from Gibraltar to Tangier. I suppose the background graphics are slightly different!

Most screens involve a left to right dash while gunning down as many of the enemy as you can. And there are other dangers, like falling girders, poisonous darts and even flying milk bottles thrown by Necros, the obligatory ruthless killer.

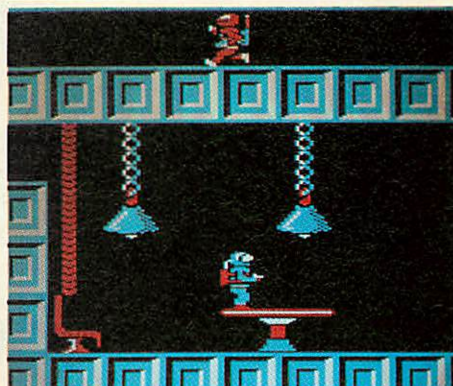
Between each level, you retire briefly to Q's workshop to pick up the latest secret weapon. It could be a crossbow, a mortar or even a ghetto-blaster! Unfortunately, there are four to choose from in each case, only one of which is useful, and you have five seconds to choose it!

Game-play is quite fiddly, especially as the instructions don't list all the keys! (The ':' and '/' keys are jump and duck.) When under fire, cursor/gunsight movement is rather slow, making shooting soldiers difficult. The sprites are not detailed but are adequate. The backgrounds are slightly better but do not scroll very smoothly.

This isn't the best game I've seen, and has very little to recommend it except for the mode 1 digitised loading picture of Timothy Dalton!

Robert Ball

STRYKER STRIKES BACK



Codename Droid: Stryker's Run – Part 2; Superior Software; BBC and Master £9.95 (cassette), £11.95 (5.25-inch disc), Electron £9.95 (cassette), £14.95 (3.5-inch disc), Compact £14.95 (disc)

Normally when I see a sequel, I yawn and give up there and then. However, with *Codename Droid: Stryker's Run II* ('*Droid*' for short), I'm glad I didn't.

Although there are elements of *Stryker's Run* in *Droid*, they are few and far between and this makes it an almost entirely new game.

It is still a case of you against the Volgans, but this time you must infiltrate their underground base. Not being an expert in kung fu, you have been given a trusty blaster, a protective suit and a small supply of mines.

The action takes part in four zones of the base, each zone having three levels. The screen displays roughly a sixth of a zone at a time and scrolls as you move. To move between zones and levels you need the lift, and to use the lift you need a lift pass – no pass, no ride! Passes can be found dotted around the base, as can fuel cells to recharge your blaster and suit. The idea of the game is to collect some fuel rods and a navigation chip, then steal the Volgans' latest ship on the last level.

The graphics are colourful and well designed. Sprite movement is excellent with careful attention applied to the animation. The sound is simple but informative.

Overall the game is very good, if a bit easier than most puzzle-type games, although this makes a refreshing change from not being able to get anywhere!

David Lawrence

"Play It Again, Sam"

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SOFTWARE

TO C OR NOT TO C?

You wait ages for one and then four come along all at once. . . Adam Denning looks at the implementation of C on the BBC micros

Just when everyone had written off the BBC micro family as a vehicle for the C language, four C compilers have been released in quick succession.

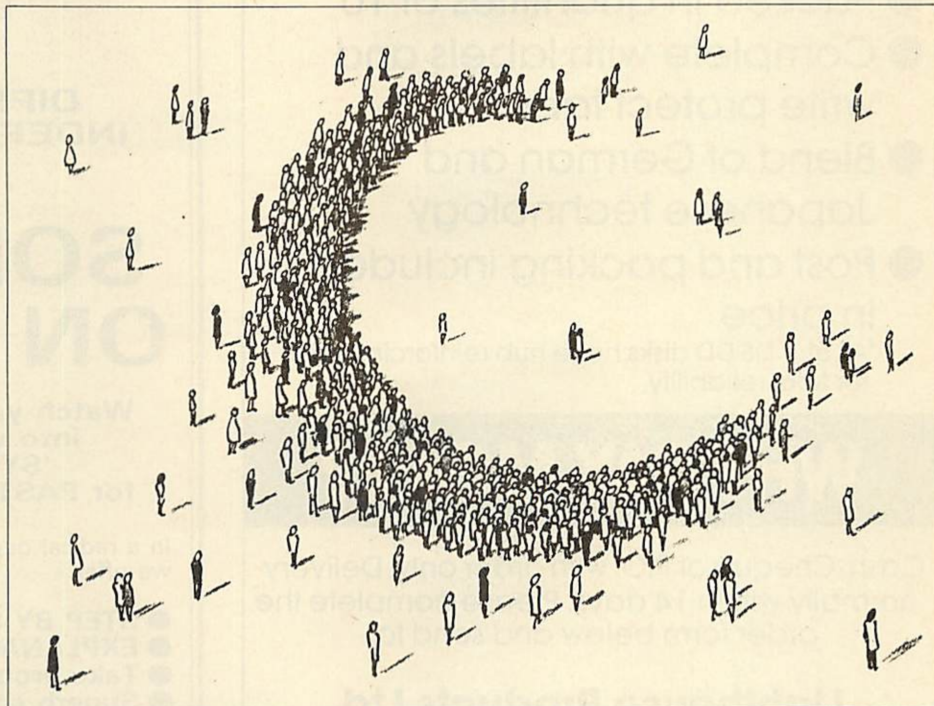
They range from full-blown Kernighan & Ritchie compilers from Acornsoft and Beebug to the Small-C implementation from Mijas. The fourth is Brasscourt's C compiler, which unfortunately was launched too late for this review. 'Kernighan & Ritchie compiler' refers to the book *The C Programming Language* written by Brian Kernighan and Dennis Ritchie. This book is the C programmers' 'bible', and it defines the C language.

Since then, there have been numerous alterations and extensions, leading to the ANSI (American National Standards Institute) draft standard for C. This will become an actual standard some time in 1988 and is the one being adopted by all major C compiler writers. Small-C is an implementation of a limited dialect of the C language and was designed by Ron Cain in the early Eighties. It was produced as a series of articles for an American magazine. Small-C is intended for small microcomputer systems, such as those based around 8080, Z80 and 6502 processors.

The Mijas C compiles the program to 6502 assembler, which can then be assembled to 6502 machine code. One thing the Acorn and Beebug implementations of the language have in common is that neither produces real 6502 machine code – they're not true compilers. Each produces an intermediate 'p-code', a highly condensed version of the program, which is then interpreted by the C system as the progam is run. The p-code is, in effect, the machine code of a fictitious pseudo-machine. The C system emulates this pseudo-machine to run the compiled C programs.

This approach is necessary because of the small number of machine registers in the 6502 chip used by the BBC micro, and because the 6502 hardware stack is so small. The popular Acornsoft ISO-Pascal takes this p-code approach too.

An obvious sacrifice in this process is speed. An interpreter converting between a pseudo-machine's language and that of the true microprocessor is bound to run a program slower than if that program was executed directly.



Acornsoft C: Runs on everything but the model B

The library is an important part of C. It is a collection of functions that are used in all programs, to control input and output, or use the filing system, or even for string handling and some mathematical functions. C itself is only the bare bones of a language, the library is what makes it into a usable system. It is designed this way so that the core of C remains as far as possible the same on all computers; the library is more prone to detailed changes because it usually has to deal with the varied hardware of each particular computer.

Acornsoft C

Acornsoft C is supplied on 80-track 5.25-inch disc and on 80-track 3.5-inch disc; the first is for DFS systems while the second caters for ADFS users. Either way it works on the B+, Master 128, Compact or a second processor – everything except a standard BBC model B. The system includes the p-code interpreter, the compiler, a linker program, libraries and a version of the usual Acorn screen editor for C program development. The debugging facilities offered by the compiler are minimal; a compiler option may be used to cause the system to display the name and argument values of each function executed, but as this is achieved just as easily by inserting relevant printing statements, it isn't much of an advance in debugging technique.

The library supplied with the system is pretty standard given the limitations of the computer system it has to run on, and it also includes a few BBC-specific extensions to allow operating system access.

One omission from the library is the complete set of mathematical functions – sine, cosine, logarithm and so on. This hampers all this implementation when writing large programs, but C is really meant as a 'systems programming language' for writing utilities. Indeed it was originally designed to write the Unix operating system. The lack of a sine function may not be such a problem for this sort of work.

One useful feature of the system is the SETPATH command – this is similar to the

Unix or MS-DOS PATH command in that it specifies a number of directories to be searched for given files. Acornsoft C uses it to locate the commands, header files and so forth, and it is intended for use with the ADFS and network filing systems.

When a program has been compiled and linked using the Acornsoft C system, it may be run from the interpreter. There is no stand-alone system so anyone who wants to run such a program will need a copy of the Acornsoft C system as well as the executable code.

Beebug C

Beebug C is supplied as two 16k EPROMs and a 40/80-track 5.25-inch disc. No doubt 3.5-inch versions will be available too as the software is Compact-compatible. This system will run on a standard BBC model B or more recent machines, and it requires only one disc drive.

Like the Acornsoft system, Beebug C takes over the machine when it is selected and presents the programmer with a prompt, a $, at which you can type a small number of commands, or run a C program.

Commands exist to compile a program or link it, and sundry utility commands are provided too.

Unlike Acornsoft C, there is no editor supplied with the system. To generate and alter source programs, then, you must use a wordprocessor or text editor which is capable of creating ASCII text files, perhaps *View* or *Wordwise*, or *Edit* if you have a Master. When a source file has been created it is compiled using the environment's COMPILE command. This may be given various options, allowing you to select optimisation, define pre-processor macros, insert debugging information and generate listing files. Like Acornsoft C, the debugging facility is of minimal use. This one causes the line number, function name and source file name to be displayed when an error is encountered. An add-on package which should be considered by both Beebug and Acornsoft is a source-level debugger program.

One Beebug compiler option that ought to be unnecessary is /LSPACE, which allows you to specify the amount of space reserved by the compiler for literal space (string constants). Without knowing the details of the compiler software, I would have thought that it could be allocated automatically as strings are encountered in the source text. Still, it's only a minor point.



Beebug C: Runs on BBC B as well

Once a program has been compiled, it, and possibly other previously compiled modules, must be combined with various library functions to create the executable program. This is the job of the LINK command. This command has options allowing you to specify the name of the output, the names of libraries to be examined, the start address and whether the program is to contain debugging information or not. The executable code thus produced may then be run using the interpreter's RUN command, which allows parameters to be passed to the program. The RUN command also allows a program's standard input, output and error streams to be re-directed, as in the Acornsoft package, but the syntax used for this is by no means standard. For example, to run a program called MYPROG with arguments arg1 and arg2 with its standard input coming from a file called INFILE and its standard output going to a file called OUTFILE, the command line would be:

```
RUN /INPUT=INFILE /OUTPUT=OUTFILE MYPROG ARG1
```

which is rather unwieldy. Considering that /INPUT=INFILE must be at least as difficult to interpret as the more usual /INFILE notation, it's a pity that Beebug hasn't chosen the standard syntax.

Beebug plans to release a stand-alone package for its C system, which will include a full trigonometric library. No doubt this will be examined in greater detail when it is released, but it is mentioned in the manual as an extra linkage option, /STANDALONE. When this option is available it will mean that compiled C programs may be run on systems not equipped with the Beebug C ROMs.

Mijas Small-C

This system is supplied on an 80-track disc for DFS systems or as a set of ROMs and a disc, but it is available by special request from Mijas in most other formats, including ADFS. It must be emphasised that this compiler system is quite different from the others – it is emphatically a Small-C implementation. In fact it is an implementation of the Rat-C compiler described in *A Book on C* by R E Berry and B A E Meekings.

The system comprises three distinct parts: the compiler, the 65(C)02 development system and the source-level debugger. It's ironic that a proper source-level debugger is provided with this Small-C.

The compiler is usually run with the MAKE command. This runs the compiler pre-processor, the compiler itself, the assembler and then the linker, to produce an executable program, which may be run on its own. This MAKE is quite different from the powerful program maintenance program supplied with Unix. Nevertheless, it does automate the compilation process.

The library supplied with Mijas C is fairly simple, providing only the most commonly used input and output routines, string handling operations and character classifications. Interfaces to the BBC micro's operating system are provided through functions such as _OSBYTE and _OSWORD, and as the compiler produces assembly language, it is very easy to mix Small-C and your own assembler. The code produced calls subroutines within the Small-C system to interpret the Small-C keywords and constructs. That means that the C programs can't be used alone, even though they are entirely machine code.

The Mijas 65(C)02 development system, provided with, and required by, the compiler, is an assembler, linker and debugger package for 6502 assembly language. It is useful package in its own right and was reviewed in July 1987 *Acorn User*. Perhaps it is worth considering this Small-C package as a really powerful assembly language development system, with the added advantage of a C-like language available if you want it. The source-level debugging system

supplied is really meant for assembler development. It manages to display the C source text by displaying the assembler source with the C program as comments. Considering that it's thrown in free, it's nothing to sniff at, and will almost certainly come in handy during program development. The catch is that to use it you cannot avoid getting down to assembly language.

Libraries

The Acornsoft and Beebug libraries take opposing approaches; Acorn provides a library conforming to the appropriate C and X/OPEN standards, but with relatively few extensions to give easy access to the BBC operating system. Most programmers could write the necessary functions in C, and two examples are given in the box. The SETTIME and READTIME functions duplicate the TIME keyword in Basic. However, they are already part of the Beebug standard library. This contains a number of other familiar-sounding functions too: VDU, SOUND, OSCLI and so on, which Acornsoft C lacks. There's also a library manager utility, whereby your own functions can be added to library files. Mijas supports only a very small library, giving just the most vital functions. Again, any new functions you do need can easily be added to a personal library.

The library system really comes into its own with ADFS. You can compile sets of standard functions separately. They lie in separate files, and just need to be linked to any program that wishes to use them – they don't need to be recompiled. With DFS, you can have so few files on a disc that this not the most practical approach. The compiler, plus its library and header files, takes up most of the space on a disc, and there is only room for about five other files. It might be best to keep all your standard functions as text files, to be read off another disc into the source code of each of your programs.

The missing trigonometric and logarithmic functions are a problem. Beebug is planning to release a full maths library and Acorn states it is 'under discussion'. Presumably its decision depends on the number of buyers for the compiler.

Benchmarks

The Acornsoft and Beebug compilers were compared using the new *Personal Computer World* benchmarks. The times for each test are given in the table, as are times for the latest version of BBC Basic. All the tests were run on the same 6502 second processor, and the compilers used identical source C code. Because of this, the 'grafscrn' test is slightly unfair to the Beebug compiler, as it doesn't make use of its PLOT function. Overall, the Acornsoft C ran these benchmarks faster, though only the integer maths program proved faster than Hi-Basic 4 (1987).

Clearly portability, not speed, is the C advantage, at least on the BBC micro. True compilers on more powerful machines in general produce fast-running programs.

The standardisation of C can be gauged from the fact that all of the example programs from the Beebug manual could be compiled under Acornsoft C, with only trivial changes – to the names of some library or header files for example. The programs themselves were to a large extent interchangeable. It is worth remembering that almost every larger computer, including the Archimedes, Macintosh, IBM PC and nearly every mainframe has a standard C compiler that could run your programs.

In conclusion, the compilers to look at are without doubt the Acornsoft and Beebug implementations. Although the Mijas Small-C is very worthy, it is hard to take a Small-C seriously when there are more complete versions available. It costs almost as much as the other systems and yet offers substantially less. Choosing between Acornsoft C and Beebug C is a little harder; they both have good libraries and a reasonable range of data types. They both support a number of the latest C language extensions. Beebug C claims the edge if you have a model B, but to compensate Acornsoft C does have a full-screen editor. Even the manuals are of similar quality, so it's probably best to judge this one in terms of brand-loyalty and price.

Acornsoft C, £89.70. Acornsoft, 645 Newmarket Road, Cambridge CB5 8PD, Tel: (0223) 214411.

Beebug C, £59; stand-alone generator, £19. Beebug, Dolphin Place, Holywell Hill, St Albans, Herts AL1 1EX, Tel: (0727) 40303.

Mijas Small-C, £50 (including assembler and debugger). Mijas, Winchester Road, Micheldever, Winchester SO21 3DG, Tel: (0962) 89352.

```
/* system clock control functions

   void settime (time)   - sets system clock
   long time;

   long readtime ()      - reads system clock */

#include <h.osdefs>
#define writeclock 2
#define readclock 1

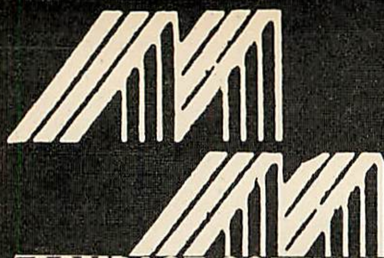
void settime (time)
long time;
{
   usrZP [0] = time;
   usrZP [1] = 0;
   call (OSWORD, writeclock, usrZP, usrZP >> 8);
}

long readtime ()
{
   call (OSWORD, readclock, usrZP, usrZP >> 8);
   return (usrZP [0]);
}
```

Functions to read to and write from the clock in Acornsoft C

BENCHMARK SPEEDS (SECS)

	Acornsoft	Beebug	BBC Basic
intmath	0.84	1.56	1.48
realmath	3.24	3.27	3.07
textscrn	30.52	14.13	15.94
grafscrn	33.18	76.01	28.69



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HARDWARE

MONITORING STANDARDS

Tired of your fuzzy old TV screen? Chris Drage examines the alternative – a sharp, clear monitor

Try peering closely at a TV for a few hours and you'll know why people buy special monitors for their micros. Computer monitors give sharper text and pictures, relieving the strain on your eyes.

The good news doesn't stop there. The cost of monitors has dropped considerably in recent years, while the quality and range of features have improved.

Before we look at the monitors on review, perhaps we should clear up a few technical points.

There are three different forms of video output from computers: TTL, RGB and PAL. TTL (Transistor-Transistor Logic) has separate connections for each of the colours that make up the screen (red, green and blue). Each can be either on or off, producing eight possible colours. Analogue RGB (Red, Green, Blue) output is similar, but the three colours can vary continuously from fully on to off, producing any colour of the rainbow and more besides. PAL (Phase Alternating Line) is a TV-type signal which blends the red, green and blue signals together with a carrier signal, and so requires only one connection.

The BBC micros produce a TTL signal output, while the Archimedes gives out an analogue RGB signal. Composite video is a mixture of the red, green and blue elements of a picture, and is used for the monochrome output.

A technical term which is often used when dealing with monitors is 'slot pitch'. The width of the tube is made up of vertical stripes, and the distance between them (slot pitch) gives an indication of the monitor's resolution – 0.6mm is standard, 0.4mm is medium and 0.3mm is high resolution. To test the monitors I have used a series of programs which should help you decide on clarity, colour saturation and so on. The tests are described in the box on page 161 and are included on December's monthly listings disc.

The monitors

Representing the budget end of the market, the Zenith ZVM-1200 has a number of features which will appeal to the home user. A very compact unit, the Zenith has an etched screen which makes it easy to use even in bright conditions.

It performed most of the tests well. It did however, disappoint with the 80-column character display, mainly because of fuzziness at the corners of the screen. Test G was also fuzzy and there were interference patterns on the dots and stripes tests. I also found the interlace jitter particularly noticeable. The ZVM-1200 is not really suitable for educational use because its mains lead has a two-pin connector midway along its length, making it vulnerable to disconnection.

Hantarex markets two popular monochrome monitors, the HX-12 and the upmarket Boxer 12. The former unit can be seen as a direct competitor to the Philips 1702 range reviewed in the November 1985 issue of *Acorn User*. The HX-12 is another monitor which will appeal to home/business users on a budget. It has a noticeably curved, etched screen, a slightly squat appearance and a number of useful controls. The HX-12 performed the tests well, and all aspects of the display are adjustable by the user. I particularly liked the position of the controls.

The Boxer 12 is basically an upmarket HX-12, but with a higher quality display tube. Its resolution of 80-column text is particularly suited to wordprocessing. A slight grumble here – I found that each pixel possessed a dim trailing edge which gave each character a shadow. My only other grumble with this otherwise excellent little monitor concerns the display tones. Turning the brightness up high enough to see blue results in the white being uncomfortably bright.

The range of adjustments will please even the most ardent knob-twiddlers, and these are accessed under a panel held in place by the brightness/contrast controls. In common with the HX-12, the Boxer 12 has an etched screen. It performed the tests very well indeed and is the pick of the monochrome monitors in this review.

The Microvitec 1431 is the colour monitor which has become synonymous with







Zenith's ZVM-1200 (top) is a basic budget model. The Boxer 12 (middle) has the edge for wordprocessing. Bottom is the ubiquitous Microvitec 1431

educational computing. Its familiar beige metal cabinet can be found in almost every school in the country. This budget-priced display has become the *de facto* standard by which other monitors are judged.

Although its performance based on the tests is only adequate, it can still be recommended. Its two greatest attributes are the backing given by the large network of service centres and the fact that a Touchtech-501 Touchscreen may be used with it.

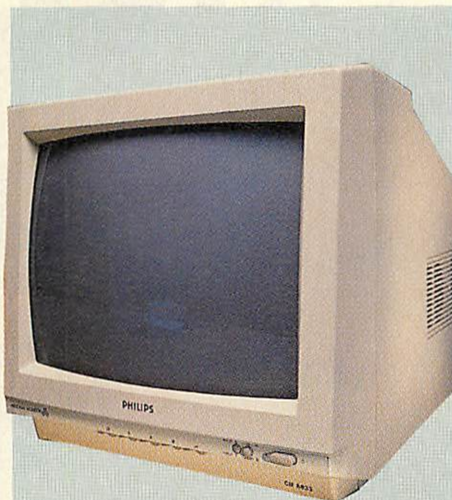
It has only one control (brightness), but the review unit was very well set up and required no further adjustments of any kind. Annoyingly, there is no carrying handle so transporting the unit is not as easy as it might be. However, for educational users, features like the moulded mains plug and sensibly spaced ventilation grilles place this monitor well within the safety regulations for even the most stringent education authorities.

At the other end of the Microvitec range is the 1441 high-resolution colour monitor. The review unit came in a stylish cream plastic cabinet which is certainly an improvement on the boxy appearance of the metal cabinet. Once again, no carrying handle is provided, but the performance of this monitor more than compensates. With a high-contrast etched screen and a slot pitch of 0.31mm, this colour monitor can truly be used for 80-column wordprocessing. Teletext screens are vividly reproduced and all colour graphics have excellent definition.

The 1441 performed the tests faultlessly and was well set up before leaving the factory. In common with other Microvitec monitors there is only one user control – brightness. The 1441 compares favourably with the popular Kaga-Taxan Vision 3 and Super Vision 3 models. The only differences are the larger 14-inch screen and the more obviously pixel-formed (stripy) characters. If you want the best display then the 1441 won't disappoint.

Several companies attempt to package a versatile VDU with a medium-resolution picture at a price most people can afford. They aim to provide an all-purpose colour screen display which functions adequately all departments.

The Microvitec 1451 AP/DS has a high-contrast display with a slot pitch of







The Philips 8833 (top) is a repackaged 8533. The Taxan 620 (middle) is ideal for graphics, the Hantarex CT900/P1 (bottom) has a big 28-inch screen

0.43mm which results in good screen definition. It performed the tests very well indeed and can be considered for 80-column wordprocessing. The three video controls include volume, brightness and contrast. The PAL input allows it to be used with a video-recorder too. This competitively priced colour monitor can be recommended for general use with the BBC range of micros.

The Philips 8533 is familiar to BBC micro users, as it is the one sold with the Compact and Archimedes computers. This model has been repackaged and marketed as the CM8833. In all other respects it is identical to the 8533. If ever there was a monitor billed as a good all-rounder then the CM8833 is it. It performed all the tests very well. The CM8833 offers unparalleled versatility as it can be used for both TTL and analogue RGB. It is the ideal monitor for those wishing to upgrade their BBC micro in the future. It also features a VCR input and, with an optional PAL tuner, can even be converted to a TV set! Although its 0.42mm slot pitch does not resolve 80-column text as well as a high-resolution monitor, with careful adjustment more than satisfactory results can be achieved – certainly good enough to be considered for wordprocessing. The CM8833 can be thoroughly recommended.

The Taxan SV620 is another very impressive unit. Lacking the versatility of the CM8833, it nevertheless performs the tests extremely well. With its slot pitch of 0.37mm, and a screen size of 12 inches, the SV620 is really in the hi-res class. This is underlined when you begin to use the unit for 80-column work – it is truly excellent. Its range of controls allow total control over the display. Interestingly, the text button can be set to generate green or amber displays to suit individual tastes.

Despite its indifferent performance with test H, the SV620 is undoubtedly ideal for graphics displays. Its colour reproduction is excellent thanks to a high contrast tube. I would have preferred to have seen a non-reflective etched screen for the money though. If you want to spoil yourself and your computer, this high quality unit won't disappoint.

Clearly the heavyweight among monitors, the Hantarex CT900/P1 SR28 is conceived as a demonstration colour display

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where a large audience is expected. Cased in metal and weighting in at 35kg it is certainly not a unit that you would care to balance on your computer plinth! With a slot pitch of 0.8mm you may be forgiven for believing that this monitor has sub-standard resolution, but this is not the case. When viewed from the recommended minimum distance of five metres, the CT900/P1 produces a display comparable with a high-resolution monitor. It performed the tests extremely well.

The target user will not relish having to purchase more than one of these units and Hantarex has recognised this by providing the CT900/P1 with plethora of inputs and controls. Inputs include composite video, analogue RGB, TTL RGB, luminance/chrominance and audio. There are no less than 10 picture controls. This variety permits a number of different systems to be connected, including VCRs. On the audio side the unit features twin speakers. All controls and selectors under the front panel are easily accessible. This monitor is aimed at educational establishments and businesses where computers are used for seminars, demonstrations and so on.

Conclusion

If you want a budget monitor as a first buy, then the Zenith ZVM-1200 probably is as good a monitor as any to start with. For the discerning wordprocessors among you, the Boxer 12 is the best of the monochrome bunch. For those with the cash who feel the need for a high-resolution colour display, my choice would be the Taxan SV620. It beats the Microvitec 1441 on price, although the latter unit does have a more robust metal cabinet, which may sometimes be important.

Undoubtedly, the medium resolution colour monitors offer the best all round performance-for-price for BBC micro users. The Philips CM8833 is the best in this area. However, where lower cost and robustness are required the Microvitec 1451 should be considered.

For businesses or educational establishments requiring a large VDU for demonstrations, the Hantarex CT900/P1 SR28 is an extremely versatile unit. One final word about prices: do shop around for the best buy. I have listed the lowest prices I could find at the time of writing, but you may be able to better them!

TEST SUMMARY CHART

		Microvitec			Hantarex		Philips	Taxan	Zenith
	1431	1451/AP	1441	HX-12	Boxer 12	CT900/P1	CM8833	SV620	ZVM-1200
Test A	2	4	5	3	4	5	4	5	3
Test B	2	3	4	3	5	4	3	4	4
Test C	4	4	5	3	3	4	4	4	3
Test D	3	3	5	4	5	3	4	4	4
Test E	5	4	5	4	5	5	5	5	4
Test F	3	3	5	5	5	5	5	5	5
Test G	2	3	5	4	4	5	4	4	3
Test H	4	5	3	2	2	3	5	3	2
Test I	4	5	5	4	3	4	5	4	3
Test J	3	4	4	3	4	5	4	5	3
Test K	3	4	5	3	4	5	4	4	3
Target price	£175	£255	£360	£80	£90	£690	£275	£280	£85
Value for money	3	4	3	3	4	4	4	4	4

KEY: 5 = EXCELLENT, 4 = GOOD, 3 = SATISFACTORY, 2 = POOR, 1 = VERY BAD

THE TEST PROCEDURE

As with previous VDU reviews, I have used the suite of test routines first published by *Acorn User* in June 1984. These appear on this month's listings disc. To the original suite of nine routines I have added two further tests (J and K), and a test card (L), to help you set up your monitor. You may find these useful when evaluating any monitor you are considering purchasing.

Test A This fills the screen with random lower case characters in mode 0. Each character should be distinct.

Test B Alternating inverse Ms and Ws. Monitors find these difficult to resolve. Particularly check the screen edges.

Test C This causes the screen to flash alternately between black and white, testing if the monitor's power supply can cope with rapid changes. The build-up of the white screen should happen instantly.

Test D There are 15 horizontal bars printed across half a mode 0 screen. The spaces between each white bar should be uniformly black, as should the right-hand screen. Uneven shades of black indicate the low frequency of the monitor.

Test E The border drawn round the screen should be straight and fit on the screen evenly on all sides.

Test F The solid circle drawn in mode 0 should be central and show no signs of being oval.

Test G This a rather severe test of a monitor's ability to resolve colours. Each band should be distinguishable.

Test H A monitor should be able to display text/graphics immediately and remove them instantly. No image should remain after the text is removed.

Test I The colour test is included to enable a comparison of the clarity, richness and depth of the colours to be made.

Test J The dot pattern is a severe test of the monitor's resolution. Check for interference patterns.

Test K Similar to J above. Again check the monitor's ability to resolve the vertical stripes without reducing them to interference patterns.

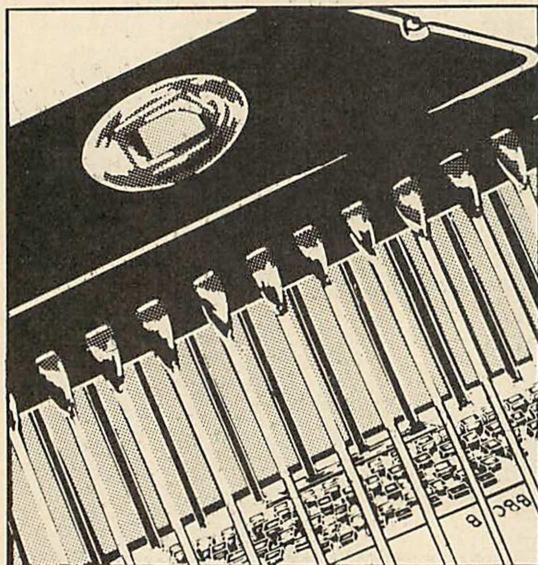
Test L Not really included as a test but as a guide for adjusting your monitor.

How each review monitor coped with these tests can be seen in the test summary chart. When making comparisons it is important to compare like with like. To compare the scores of a hi-res colour monitor with monochrome is unrealistic.

STOP PRESS

AU OFFER

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Stop Press, the most highly acclaimed desktop publishing package for the BBC micro and Master 128, is being offered exclusively to *Acorn User* readers at special Christmas prices!

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ROMS

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SOFTWARE

FAST AND FURIOUS

Real-time three-dimensional graphics on a BBC micro? It's possible, finds Geoff Bains

Video graphics seem to occupy more and more airtime. Television is full of images of spinning, swirling globes, cameras and all manner of everyday objects. Now BBC micro owners can get a taste of animated computer graphics and produce dynamic displays of their own.

If it wasn't for games like *Aviator*, *Elite* and *Cholo* nobody would have dreamt that complex animated sequences were even possible on a home computer. Even so, it seemed there was no way that generalised, controllable graphics could be produced on this machine.

Silicon Vision has overcome the problems and produced a package which allows even novices to produce stunning effects.

At £49.95, the *Real-Time Graphics System* is quite reasonable. It's a development of the earlier *3-D Graphics Development System* marketed by Glentop Publishing, but the author has developed the idea quite a lot further.

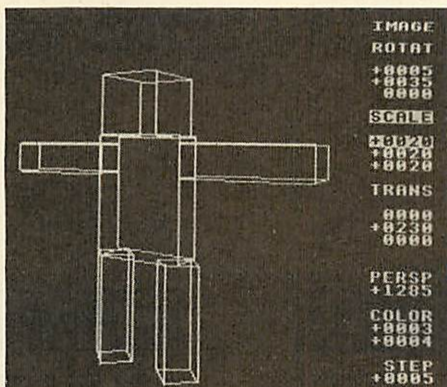
The *Real-Time Grahics System* (*RTGS*) provides a lot for the money. The system comprises no less than five discs, a 32k ROM (supplied with a carrier board to take up just one slot in the machine), and a hefty manual.

It enables the BBC micro to produce static or animated displays of wireframe images without any complicated programming effort.

The *RTGS* package is in two distinct parts. The first is concerned with constructing three-dimensional models of objects. In itself this section of the *RTGS* compares well with other similar packages, such as Design Dynamics' *Interactive 3-D* or AMS' *3-D Zicon*.

Creating a model

Before displaying a representation of any object a mathematical model must be created. If the object is only to be displayed from one viewpoint then the model can simply be the screen co-ordinates required to draw out that view on the VDU. If a more sophisticated model is required then a set of 3-D co-ordinates are needed, as well as a set of routines for manipulating these co-ordinates and projecting the new view of the object onto the screen.



Build up complex images from simpler ones

All this is simple enough to do with a little geometry and a reasonable knowledge of Basic; but the results are slow to say the least. What the *RTGS* provides is a set of general manipulation routines written in fast machine code.

The routines demand a special format of model co-ordinates. These are created using the first, menu-based, section of the package – the model designer. This is supplied on one of the five discs, although it makes use of the ROM-based routines.

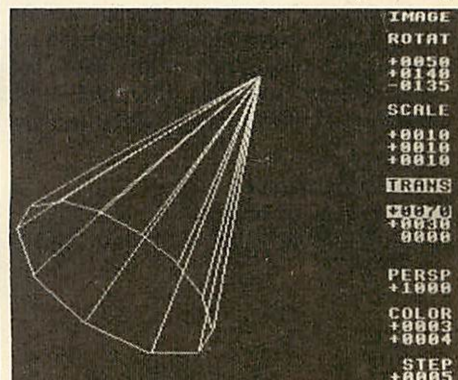
Object models are created by entering into a table the 3-D co-ordinates for each main point of the object, along with values to determine whether a line is drawn to the point and also the colour of the line.

This is the most difficult part of the whole procedure. To construct any model more complicated than a cube requires either an agile mind or graph paper.

Some help is given in the form of automatic solid generation by rotation. This enables a sphere, say, to be created by rotating a single point about another to form a circle and rotating that to form the sphere. Any solid of rotation can be created in this way with all the hard work of calculating the model data performed by the micro itself.

When the data table has been entered either manually or by the software, it can be edited simply, sections can be deleted and of course the data can be saved to disc. Entering the model data is the weakest part of the software. Given the power and flexibility of the some other features of the *RTGS* package it would have been better to have seen a more interactive model-creation procedure. Design Dynamics' *Interactive 3-D* uses cursor-controlled direct manipulation of three separate views of a model to construct a 3-D image on the screen and shows that such 'natural' systems can be achieved.

When the data has been entered, the model can be viewed from any vantage point, at any apparent distance and with variable perspective and magnification. The viewing screeen displays the model in a window occupying most of a mode 4 screen, with a menu to display and alter the co-ordinates of the vantage point and other viewing parameters.



A shape can be rotated

At this point the images of the model can be either dumped to an Epson-compatible printer or saved to disc for dumping at a later date.

Building macros

More importantly, the model can be saved for use as 'macro'. This is a model used as a simple building block as part of the creation of a far more complex object such as a figure.

By creating the macro models of just a few simple solids (cubes, tetrahedrons and the like), just about any complex model can be built up with reasonable ease. This can be done quite simply despite the inherrent difficulties of the system. It is a shame that a bigger library of common macros is not

SOFTWARE

provided. However, creating these yourself is simple enough and provides useful experience of the process.

All this provides static pictures only. Although the *RTGS* provides a powerful 3-D drawing package, its real power and attraction lies in the second section of the software – the real-time graphics language.

The *RTGS* ROM contains high-speed routines to calculate the screen positions for any projection of the model data. Any view which can be produced by the model design software can also be produced in double-quick time by the ROM routines under the control of your own program.

A series of simple commands are used to tell the ROM the orientation, size, perspective and so forth, of the model image. By clearing the screen, altering the parameters and re-drawing the model the image is animated.

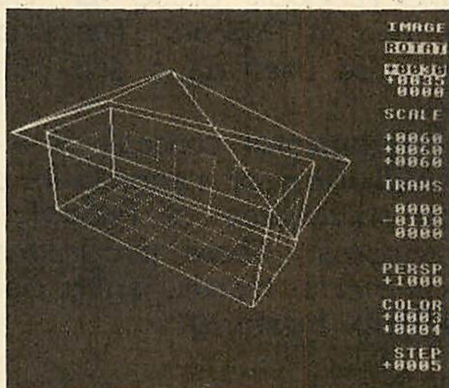
To speed things up the ROM can use its own built-in fast drawing routines (capable of plotting up to 35,000 pixels a second) instead of the BBC micro's own slower, but more fastidious code capable of a 'mere' 9000 pixels a second.

This produces a fast but rather flickery animation. The flicker can be reduced a little by surreptitiously clearing only the area just around the image. However, the *RTGS* provides an even better solution.

When using modes 4 or 5, the *RTGS* can cope with two separate screens at once, each taking up 10k. A model is drawn on one screen while the other is displayed. The screeens are then swapped instantaneously and the old image erased and a new one drawn. All this is undertaken automatically by the *RTGS* ROM, and the screens swapped each time a model is drawn. The result is perfect flicker-free animation of the same quality as seen in games like *Elite*.

The *RTGS* routines are controlled, and the parameters passed, by a peculiar and rather convoluted system. The parameters such as the co-ordinates of the viewpoint, the magnification, the perspective value to be used and so forth, are held in a parameter block in RAM. This can be changed directly by poking in new values, and this is the only realistic method of using the system from assembler, but from Basic it's tedious.

The alternative is to use specific Basic variables such as yrot% and proj% to hold the variables. Issuing a star command will



Accurate perspective is possible

then make the *RTGS* transfer the value from Basic into the parameter block. The parameters can be altered individually with a separate star command provided for updating each parameter, or updated automatically each time the model is redrawn. The first method is the quickest as the ROM only concerns itself with those parameters which change, but the second method is much simpler to program.

This is still a rather complex procedure. Using either the resident integer variables (A%-Z%) or star commands, which directly alter the parameters stored internally by the ROM, would seem a much easier method. Presumably the quest for speed is behind the choice.

Speed is certainly evident. To produce a smoothly tumbling cube on the screen needs only this kind of thing:

```
 500 xscl%=100:yscl%=10
0:zscl%=100:proj%=0
 510 *PAGE1
 520 CLS
 530 *PAGE2
 540 CLS
 550 *SCRN1
 560 *PAGE1
 570 VDU 28,14,21,25,10
 580 VDU 29,640;512;
 590 *CLS3D
 600 *TOGGLEON
 610 yrot%=30:zrot%=0
 620 FOR I%=10 TO 360 S
TEP 10
 630 xrot%=I%
 640 *RGL3D
 650 NEXT I%
 660 UNTIL FALSE
 670 END
```

Of course a working program would also need all the unused variables to be zeroed, the screen mode set, the model data loaded and a few other chores done. However, this serves to show how simple using the *RTGS* really is.

With very complex models, or when many different objects are to appear on the screen at once, the *RTGS* soon meets its limitations. However, all generalised 3-D display software has similar limits and the *RTGS* scores well above the majority of other systems on most counts.

For users interested in getting around these limitations the RTGS provides another level of usage. The primitive routines in the ROM are available for direct use by the programmer. These routines are mainly concerned with the mathematics of the 3-D perspective transformation and the projection required to generate a three-dimensional image.

Using the *CALC command a set of 3-D co-ordinates can be individually (and extremely speedily) turned into the corresponding screen co-ordinates, according to the rotation, scaling, perspective, and other factors current at the time.

This enables you to write your own display routines, which could get around difficulties associated with the methods normally used by the system. For the really ambitious, the system even provides the possibility of extensions to drive external graphics cards, such as the Pluto boards, for displays of professional speed and quality.

To help you get to grips with the system, a well-written 100-page manual is provided and the five discs contain a great many demonstration programs. The discs also contain a multi-plotter driver disc for driving popular plotter models, a database of model data and demonstration programs, as well as data provided for familiarisation with the software.

These programs are essential as using the *RTGS* takes quite some getting used to. However, the effort is certainly worth it. If you are interested in using your Beeb for real-time graphics displays there is no better package currently available and no more dramatic demonstration of the potential of the machine.

The Real-Time Graphics System *is compatible with all versions of the BBC micro and costs £49.95 from Silicon Visions, 47 Dudley Gardens, Harrow, Middlesex, HA2 0DQ. Tel: 01-422 2274.*

Magazine index price cut

The price of the *Magazine Bibliography* from McHugh Enterprises has been drastically cut. The bibliography, which has 23,000 entries, now costs £5 for each of the 17 parts.

The index covers all articles in *Acorn User* and the other Acorn magazines. The database can be searched by keyword, and it takes about a minute to scan any one magazine. It is also available to LEAs on licence for £25 per part, and may then be copied by all the schools in that district.

On-screen lab simulation

Shell Softlab *Guides to Laboratory Work* simulate a first-class science laboratory – on a screen. New titles such as *DC Electricity* and *Heat and Temperature* allow you to assemble lab equipment on screen and 'perform' experiments. There are also pre-packaged experiments on disc.

The programs are Econet-compatible and teacher's notes are available. The titles cost £14.95 each and are available from Holder and Stoughton.

Droom for Archimedes

Droom has been re-written for the Archimedes. The original BBC B version of Resource's *Droom* is popular with primary schools for its imaginative graphics and clear text. Programmer Derek Allen has utilised the new graphics facilities of the Archimedes to enhance *Droom*'s screen display.

This package shows the difference between rewritten software and software which has been modified to run on the Archimedes' 6502 emulator. The latter will look the same and run slightly slower than on a model B. A re-write takes advantage of the new screen modes, better colours, and is much faster.

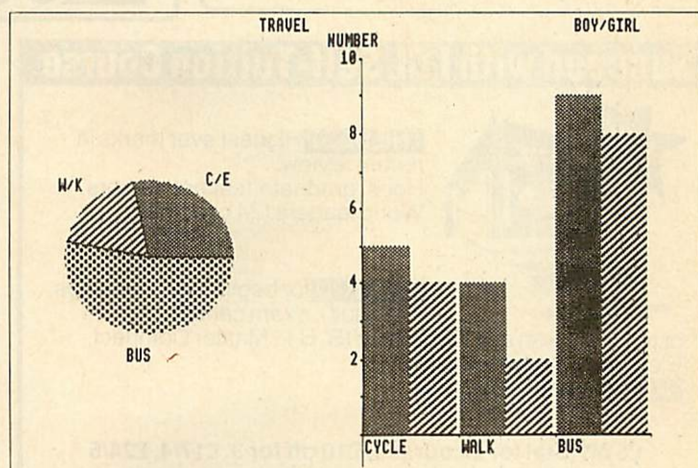
Acorn hopes that much more software re-writing than simple emulation will take place. If it doesn't, then the the extra facilities of the more powerful machine be largely redundant.

The latest Acorn Archimedes software catalogue lists over 75 educational programs to run on the Archimedes, plus 40 others using the 6502 emulator. Many of these are existing BBC B titles, written in BBC Basic, which needed little or no modification for the Arc.

School graphics tutor

Teachers seeking to widen the use of computers in their schools will welcome the *Across the Curriculum* packs from the Microelectronics in Education Development Unit (MEDU). The packs are designed to help teachers use existing software.

Graphics Across the Curriculum demonstrates the use of *ViewPlot* to display data. It uses worked examples in fields such as history, childcare, biology, CDT and home economics. Each subject is considered via a case study and examples are worked by reference to the screen prompts generated by *ViewPlot*.



Analysing journeys to school using *ViewPlot*

A second package, *Spreadsheets Across the Curriculum*, examines the integration of *ViewSheet* in several subject areas. The packs cost £7.50.

Simple type

Typesetter! from Sherston Software has been extended with a 'primary writing' font disc. The letters are formed in the clear and simple fashion taught by primary teachers.

The price of the font disc will be low, around £5, to discourage copying of discs.

Adventures in IT

Scoop is an adventure game aimed at English and business studies students. The main character, a journalist, has to use information technology electronics including Prestel, telex and fax.

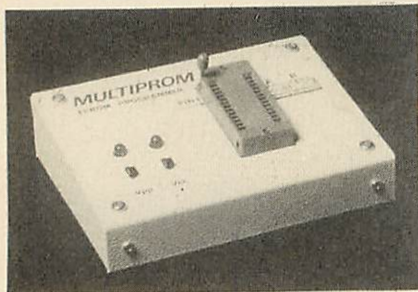
The package is designed to be integrated into the teacher's classwork. Extension tasks, not all related to the computer, cover ethical and social questions, as well as the technology.

The software, which is part of the Computers in the Curriculum project, costs £12.50 on 40-or 80-track disc and is distributed by British Telecom.

Contacts

British Telecom Education Service, PO Box 10, Wetherby, West Yorkshire LS2 3EL. Tel: (0937) 844443.
Hodder and Stoughton, Mill Road, Dutton Green, Sevenoaks, Kent TN13 2YA. Tel: (0732) 450111.
McHugh Enterprises, 43 Hookstone Oval, Harrogate, Yorkshire HG2 8QE. Tel: (0423) 887742.
MEDU, Bishop Grosseteste College, Newport, Lincoln *LN1 3DY*. Tel: (0522) 44713.
Resource, Exeter Road, Doncaster, DN2 4PY. Tel: (0302) 63800/63784.
Sherston Software Swan Barton, Sherston, Malmesbury, Wiltshire SN16 0LH. Tel: (0666) 840433.

MULTIPROM EPROM PROGRAMMER



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27256-25	£5.00	£4.90	£4.60

Both type require 12.5 Volts Vpp
S.A.E. for details of Uviprom conversion 21 Volts to 12.5 Volts datasheet

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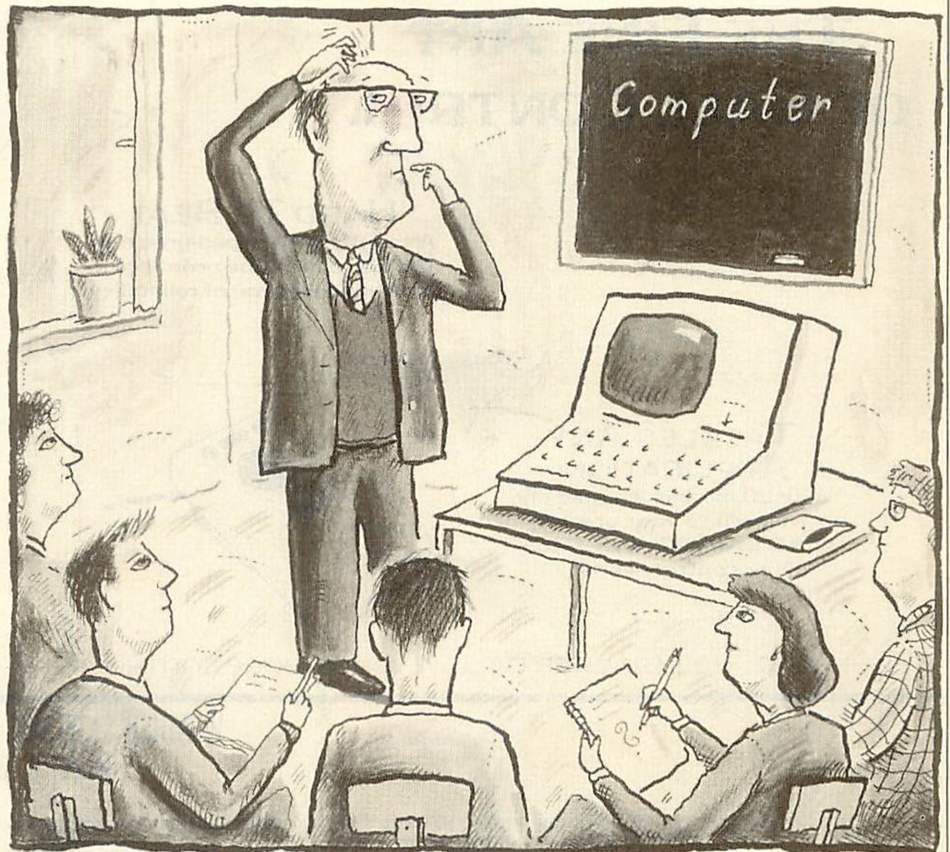
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EDUCATION

PLANNING THE FUTURE

You cannot get the best from your school's micros without a strategy for information technology

Chris Drage and Nick Evans



The Government's Educational Support Grant (ESG) initiative, which gives £19 million for raising the profile of computers in schools, highlights the importance of adviser and teacher training in this process. The large number of new advisory teachers seconded – 700 over two years – also indicates the substantial scale of the task. This month we look at a few of the issues that need to be tackled both by the trainers and those being trained.

Computers in schools have been with us for five years now, since the Government's first scheme which put a computer into almost every school. What was to be done with it remained largely a mystery in the early days. When the possibilities of new technology in the classroom were explored in part by bodies such as the MEP, a certain unity of purpose and direction emerged. This may be summarised in the following way:

- You can learn about computers
- You can learn with computers
- You can use the computer as a tool – a stimulus for ideas, a resource and a means to gain access to new information.

The emphasis on these different aspects has changed during the development of the use of computers and information technology (IT) in the classroom. Computer studies is still a popular subject, but it is no longer the only way a child can gain access to a computer in a secondary school. Although many primary teachers have found the arithmetical drill and practice program a useful supplement to their own teaching, most can now see a much broader range of computer uses. The processes that brought this state of affairs about are discussed in *The Microtechnology Report* from Resource.

The main problem that the new ESG advisory teachers will have to deal with is the existing inequality of provision of materials in schools. This doesn't only relate to the amount or value of hardware and software, but also to its nature. Much school software has been bought to teach specific things – formation of ox-bow lakes, the microprocessor's fetch-execute cycle or geometric transformation for example. This has often been done without regard to any integrated policy or curricular structure. Although these items have their individual value, they make more coherent computer use across the curriculum difficult. This is not to argue that schools should have identical materials, centrally purchased and handed down from on high. It is obvious that schools have different needs. However, providing packs of wide-ranging materials that cross course or subject boundaries and encourage an open-ended, exploratory approach to learning is definitely to be encouraged.

In the humanities for example, there are already a range of packages which look at a topic from an historical viewpoint, then relate to geographical issues and go on to develop the social and moral aspects. This encourages children to understand that human development is not governed by single influences acting in isolation.

The first question that many teachers will ask, especially if they have recently been made responsible for IT in their school, is 'Where should I begin with my IT plan?' The obvious starting point for any school is to look at the available tools. Wordprocessors, database management systems, spreadsheets, graphics packages, desktop publishing software and communications are all likely to be needed.

The problem is not solved by making that list. There is such a wide range of each type of tool available. As far as possible the school should try to choose software tools which will allow information to be passed between the various packages. Unfortunately such software is sometimes unfriendly or difficult to use, but newer generations of software do seem to be improving. So, for example, the *Inter* suite from Computer Concepts provides all of the four main business tools in a powerful but relatively flexible form.

It's expensive to buy this type of software, however, as it is highly sophisticated. You may decide that something very simple and straightforward is all you need at the moment, in which case a package like

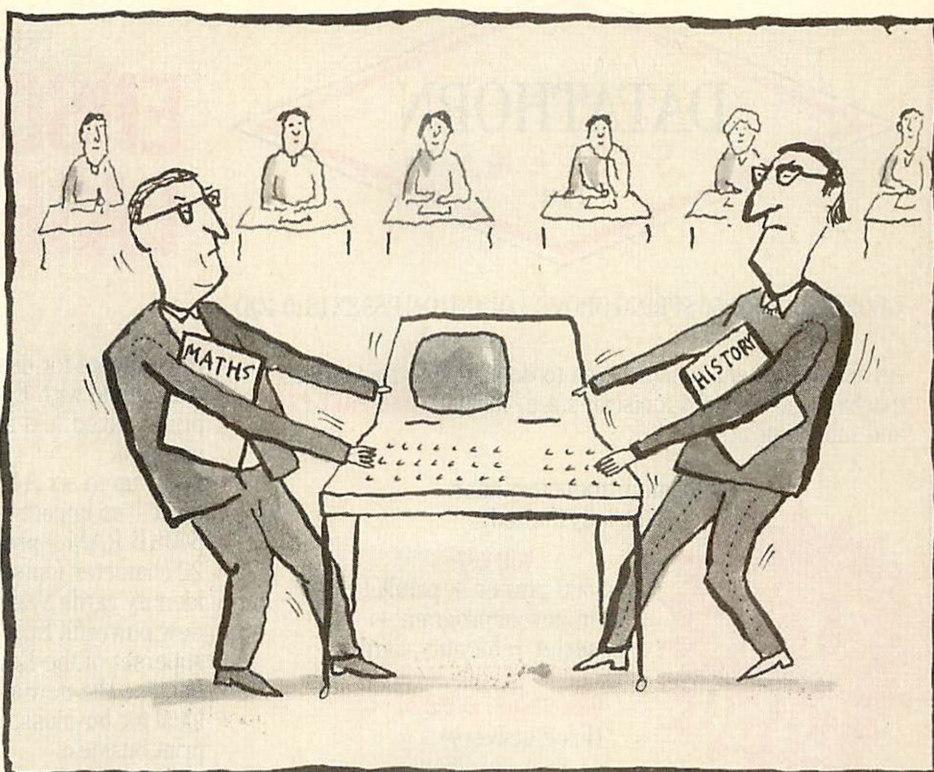
ILLUSTRATION BY AXEL SCHEFFLER

Mini-Office II will perhaps be the most suitable. There are often problems using files from a particular wordprocessor with another desktop publishing package. Some DTP packages will not 'talk' to the most popular educational wordprocessors such as *Folio* and *Edword* but insist on *View* or *Wordwise* format files. That sort of mismatch stores up trouble when new staff trainees begin to find their feet.

More generally the format in which the school buys software is important. ROM-based packages are usually more powerful than those which are disc-based, but they cannot be easily moved between machines unless you use a cartridge system. So an important question to ask is 'Do I want this machine to be a dedicated word-processor?' Some packages, like *Typesetter!* from Sherston Software, allow you to prepare the micros on which you are going to operate the software using a master start-up disc. The work discs may be freely copied within the school and used on as many machines as necessary. In this way, one package can be used in several locations at the same time. Other tools are sometimes available in network versions, or site licences are available.

Equipped with a suite of inter-related tools, the IT co-ordinator can now look more specifically at cross-curricular work. The Government's programme is aimed at breaking away from the closed-door approach to education – each subject taught in isolation without any relation to eachother. Many people see the primary school topic-based approach as a useful model for change but others find this teaching scheme as too restrictive. For some the communications between the subject areas remain too artificial. For these reasons consultation and co-operation between school departments is essential. Beginning that co-operation requires an understanding of the personalities involved – there are no fixed guidelines! The IT co-ordinator will have to prove that everyday use of the computer for cross-curricular integration enables tasks and topics to be dealt with more effectively, more dynamically and in a fashion that is educationally justifiable. It is important that any new teaching style deals with the needs of the child and the syllabus.

Unless you can work effectively with the human resources at your disposal then it's not worth trying yet – you won't get a second chance with that set of staff. Although the IT co-ordinator can suggest ways forward, it always will be the individual teacher who must make his or her own microelectronic salvation! The new ESG trainers will be briefed with the latest information on software and hardware, and it will be the task of the trainees in schools to extract as much as they can during the short periods the trainers will be able to devote to individual teachers.



The actual planning of an IT policy for a school will, of course, come down to decisions and compromises made by the IT co-ordinator and the head and their deputies. It is not possible to have fixed policy that can fit into all schools. The best way to help is to suggest certain key questions which need to be asked if the right decisions are to be made. Although the list in the box on the left is not comprehensive it provides a starting point for discussion.

There are many more questions which arise either as a result of the questions or independently. The answers will not be the same in any two schools. Each plan will have to be tailor-made and it will need the careful use of every facility that is made available by any organisation that you can contact. Software companies, advisers, other staff, INSET courses, computer clubs and even the pupils themselves are sources of information which must be tapped to make your school IT scheme as effective as it can be.

The Microtechnology Report *is an MEP-sponsored document by Nick Evans. It is available from Resource, Exeter Road, Doncaster DN2 4PY, price £4.95.*

KEY QUESTIONS

- Which areas of the school will benefit most by the introduction of new technology immediately?
- Who are the key teachers with an enthusiasm for information technology who can transmit that to others?
- What is the best method of equipment distribution? A computer room? A school network system? A stand-alone machine for every classroom?
- What facilities will be needed for administering the micros?
- How will the software buying policy be decided, and by whom?
- What changes are likely to take place in the curriculum, teaching methods, classroom or school organisation if a cross-curricular approach is adopted?
- How sure are all staff concerned that the use of micros will enhance their own work, the pupils' experience or the practical results of their efforts?
- What is the best way to ensure the co-operation of all staff?
- Will a computer in the staff room encourage wider use?
- Is sufficient technical support available for the execution and maintenance of the computing plan?
- Will the school continuously evaluate the use of IT across the curriculum? How will it be monitored? By whom? Using what criteria?
- What results will be judged a success?

EDUCATION

THE NETWORK PAGE

Just how useful are courses on network management? Plus details of a DIN lead testing device

Robin Newman

Conferences and courses on network management are becoming more and more common, and can be very valuable sources of information and advice. This month the Network Page looks at one such conference to assess just how useful they can be. In addition, Chris Dawkins of Felstead School has designed a device for testing cables, and we describe it here. A school science department should be able to put it together easily.

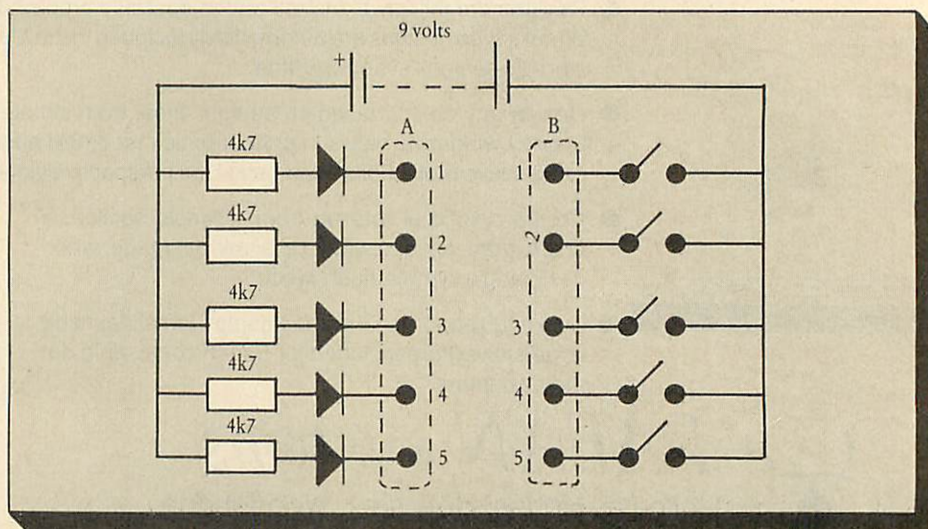
Manager's course

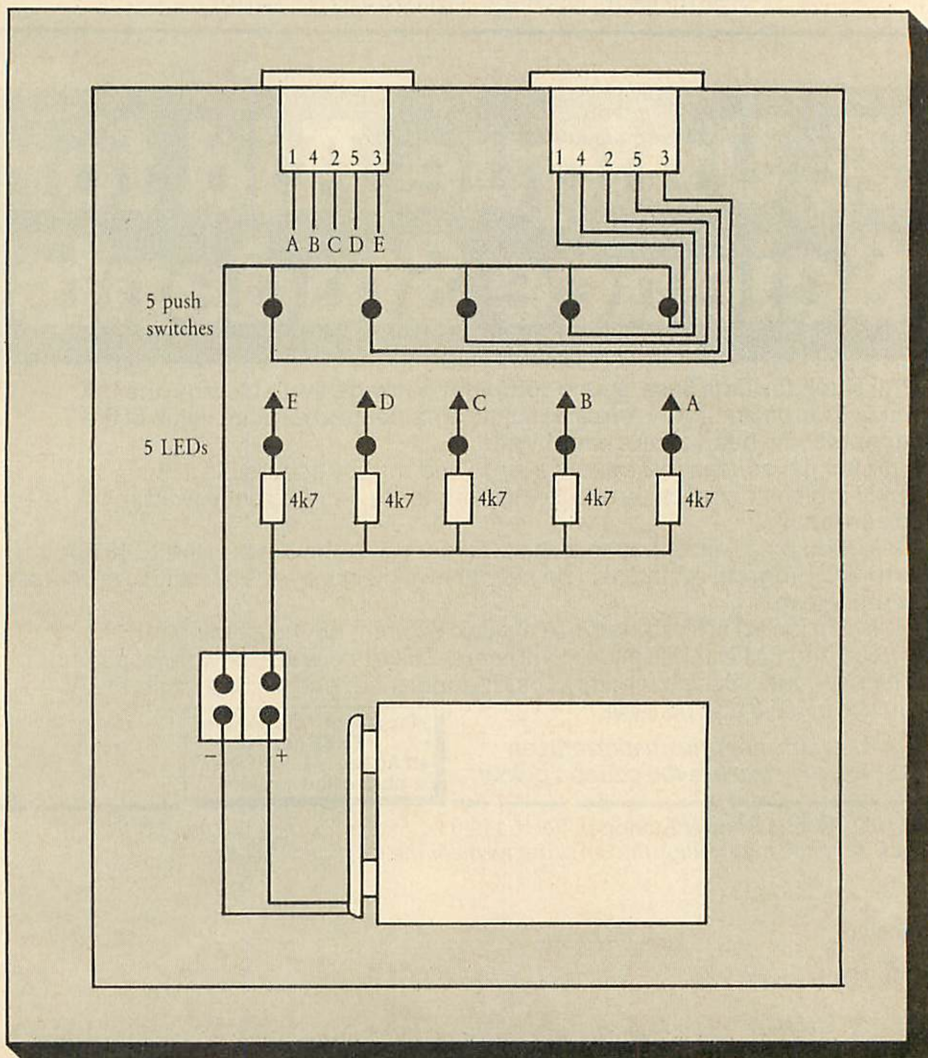
At the beginning of July, I took part in a course for Econet network managers organised by SJUG – the SJ Users Group – at Wellington College in Berkshire. There were three talks interspersed with workshop sessions where delegates could discuss their problems and try out some of the ideas discussed in the talks. The assembled expertise included Andrew Gordon of SJ Research, the author of their file server software. Several people had brought their file servers along and could illustrate their own file server structures, and some were able to solve any problems they had experienced then and there!

A lot of the discussion was specific to the SJ file server, which has a wider range of facilities than the Acorn level 3 version.

Directory structure

The first talk dealt with the network directory structure, the maintenance of the password file using the *Editpass* program, the operation of the library, and the space accounting system employed by SJ. This allocates a range of space accounts to each user and each is allocated, or credited, some space. Each directory within the root is also allocated to an account. In the simplest arrangement, each user has a unique account number, and his or her root directory will be allocated to the same number. The user will be able to save files in his or her directory, which will be subtracted or debited from the space allocated to the account. The file server manager can therefore control how much space each individual user has available. This system is





Circuit diagram (figure 1) and construction plan (figure 2) for the DIN lead tester

similar to the Acorn arrangement, where the utilities RDFREE and SETFREE control the space available.

The SJ system, however, is much more flexible. Suppose the network manager wishes users to be able to use a program which creates and uses a separate file of data. Clearly full access is needed to the data file, but the program itself should not be alterable by the user. The solution is to place the program in the same directory as the data file, one which the user owns, but to allocate the program to an account number which the user does not own and give the program public access. The account any individual program is allocated to can be changed with the *ACCOUNT ‹progname› ‹newaccount› command, eg, *ACCOUNT PROG 1 42. The user issuing this command has to own both the existing and the new account number – so it's best done by SYST.

In fact the situation is even more complicated. As well as its main account number – the one to which its space requirement is debited – each file also has an auxiliary account number. This can be displayed with *INFO, and it appears as the final item, enclosed in brackets.

The auxilliary account number can be set to an account owned by a different user, who will then have ownership rights over the file. Again the *ACCOUNT command can be used. The auxilliary account is normally zero. That's why the SYST user, who owns account 0, normally has ownership rights to all files.

Printers on the net

Many commercial Basic programs use VDU 2 and VDU 3 to switch the printer on and off repeatedly. On the network, however, this can produce disastrous results. These VDU codes are used to mark the beginning and end of a complete print job, and the network printer prints the contents of the banner file (the header identifying the user who asked for the printout) each and every time they are used. If the banner file includes a page eject, you get through an awful lot of paper.

One commercial program I recently converted to run on the network employed a machine code screen dump which sent VDU 2 and VDU 3 around every single byte sent to the printer. Graphics dumps turned out to be around 400k long! There is a solution to this problem: *FX3 switches the output stream like a set of railway points – so *FX3,0 allows output to both screen and printer, *FX3,4 outputs to the screen but not the printer, and *FX3,10 uses just the printer. You should still use VDU 2 before printing anything and VDU 3 after printing everything.

On Acorn and SJ FDFS file servers there can still be problems, as after VDU 2 the network printer cannot be used by anyone else until a VDU 3 is sent. Worse still, once you've used VDU 2, the printer server can time-out if you leave it idle for too long before sending VDU 3. The printer server moves on to deal with someone else, while your micro still believes it can print things. Usually you have to press Escape or Break to recover from this. These problems can be cured by modifying the program to send the output to a spool file, which can be printed out in one go later. This is done by inserting *SPOOL POUTFILE before the output starts, and *SPOOL POUTFILE before the output starts, and *SPOOL when it has finished. The VDU 2 and VDU 3 commands should be removed. The file can be printed later like this:

```
VDU 2
* PRINT POUTFILE
VDU 3
```

If *PRINT isn't available on your machine, use *TYPE or *EXEC. This was discussed fully in Hints and Tips, *AU* October 1987.

Alastair Shimmin of Wellington College discussed the problems of doing graphics dumps over the network. The original NFS3.34 network chip contains a bug which prevents you from sending graphics dumps to the printer server. There are three solutions. Upgrade to an Acorn ANFS or DNFS chip, or an Oundle Extended Network Filing System chip. The ENFS or ANFS chips speed up using datafiles with BPUT and BGET. Alternatively, *VIEW the screen you wish to dump on a machine fitted with a local printer and graphics dump ROM, and dump it there. Alastair has developed a printer server program which is run on station 235 using the *Printmaster* ROM (the main SJ printer server is on 254). Using this program any user can type *NDUMP and the screen is automatically dumped on the printer connected to station 235. Another command, *GDUMP, enables text to be sent to station 235 to invoke *Printmaster* commands as if they had been typed at that machine.

The final talk dealt with a variety of topics including network security, using sideways RAM and converting existing disc and tape software to run on the network. The conference was interesting and hopefully it will be repeated next year.

A future Network Page will include details of how the new Archimedes machine behaves on the network, in particular its compatibility with existing network machines and software. Until then, please send in your comments so that good ideas can be shared with others!

Notes on the SJUG conference proceedings are available from SJUG, Microtechnology Centre, Wellington College, Crowthorne, Berks RG11 7PU. Price £1.50 (members) £2.00 (non-members). These include several Basic routines.

Oundle ENFS; further details from Robin Newman, Microelectronics Centre, Blackpot Lane, Oundle, Peterborough PE8 4AT Tel: (0832) 73884.

The circuit for the test equipment was developed by Chris Dawkins, working at Felstead School.

HOW DO YOU DO IT?

The Network Page would like to give network managers the chance to tell us how they use their Econet networks. Is your network used just for computer studies or IT teaching? Do you use it to support the teaching of other subjects? What software do you use? Do you run your network in an unusual or original way? Please write in to the Network Page, *Acorn User*, Redwood Publishing Ltd, 20-26 Brunswick Place, London N1 6DJ. Any good ideas will be passed on in a future issue.

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This circuit allows you to test the DIN leads used to connect a computer to the Econet network. It is easy to build; the circuit diagram is shown in figure 1 and construction details in figure 2. To use the unit, plug the ends of the lead to be tested into the DIN sockets on the box. Then push each of the five buttons in turn. Each corresponding light emitting diode (LED) should light, indicating that the conductor in the lead is continuous and the plug connections are good. If the LED does not light then the lead has a break in it. If more than one LED shines at the same time, or the wrong LED glows, then two or more conductors are shorting together. The unit does not need an on/off switch, and the battery should last for a very long time. It is quick and easy to test any suspect lead, and it is also convenient to test all network leads regularly as preventative maintenance.

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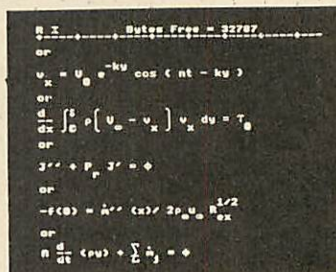
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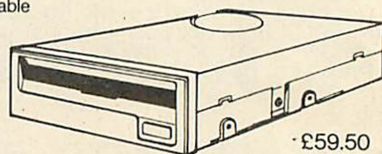
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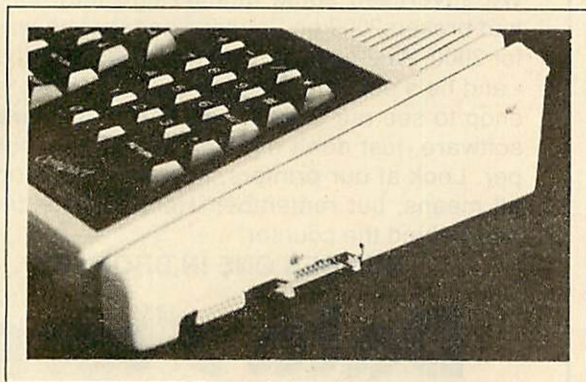
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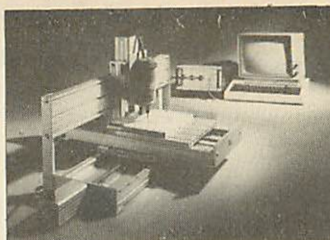
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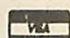
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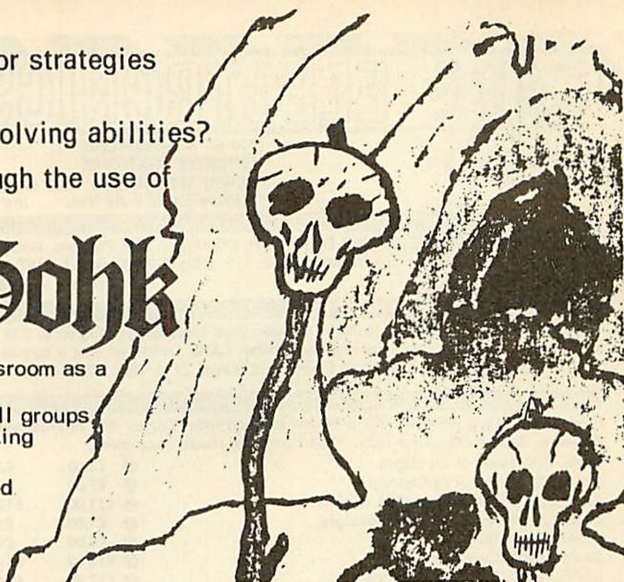
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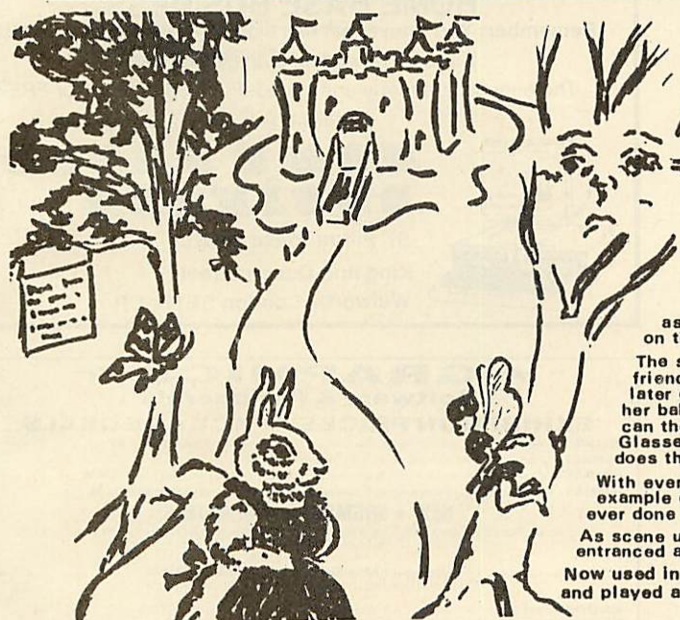
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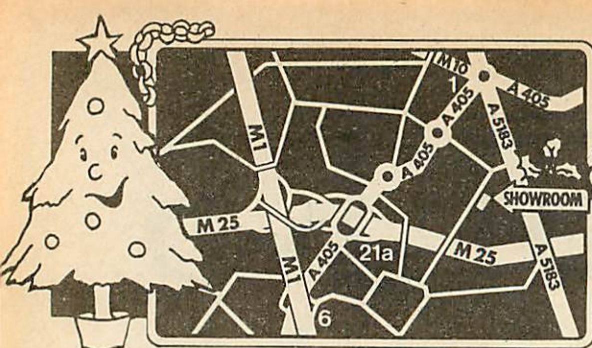
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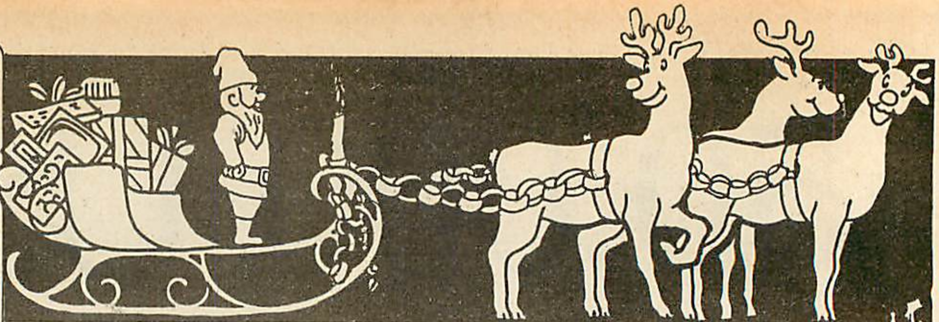
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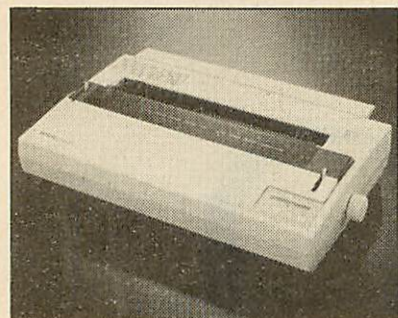
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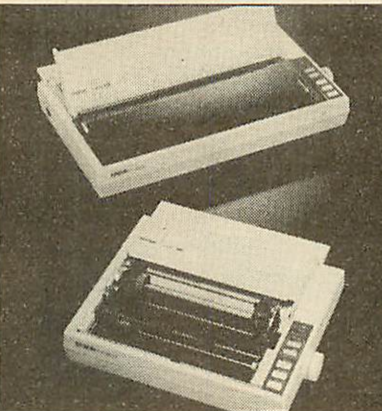
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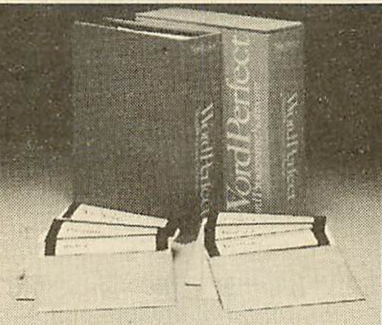
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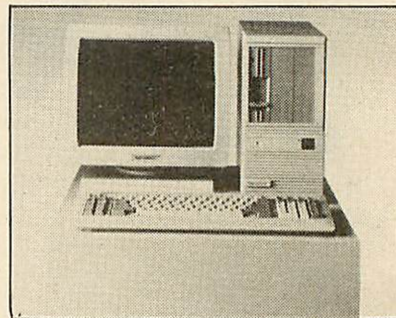
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Epson FX800 - Brand New! 240cps! Wow!	£293
Epson EX800 - 300cps & 80 column-Super Fast!	£373
Seikosha MP1300AI - 300cps!	£299
Seikosha SP180 - 100cps Bus a Great Price!	£149
Seikosha SP1200 - 120cps (Seiko-Epson owns Seikosha)	£189
MP 165 - Cheap Fast And Good Quality 180cps	£169
Oki Microline 182 - The Number 2 Brand	£184
Oki Microline 192 - Perennial Favourite	£279

WIDE DOT MATRIX PRINTERS

Star NX15 - The New Wide-body NL10!	£273
Star NR15 - Replaces the SR15-A Great Mover	£385
Panasonic 1592P - A Real Bargain, Mate!	£350
Panasonic 1595 - The Panasonic Favorite	£450
Epson FX1000 - Brand New! Replaces FX105	£379
Epson EX1000 - 300cps & 136 column-Super Fast!	£498
Seikosha MP5300AI - 132col Version of MP1300	£389
Seikosha BP5420 - 420cps Draft - 106 in NLQ	£999
MP 200 - 200cps! 132 column!	£259
MP 201 - 132 column 200cps	£294
Oki Microline 193 - Worth A Look	£359
Oki Microline 293 - Worth A Long Look	£608

24-PIN DOT MATRIX PRINTERS

Epson LQ800 - Letter Quality-24 Pin Printhead	£419
Epson LQ1000 - Letter Quality-24 Pins-132 Col	£558
Epson LQ2500 - This one is really good!	£689
Epson LQ850 - Brand New 24-Pin, Due Out Soon	Call
Epson LQ1050 - Brand New 132 Column 24-Pin LQ	Call
Seikosha SL80 - 150cps Draft - 50cps LQ	£280
Star NB15 - The big, up-market Star 24-pin 300cps	£598
Star NB24-15 - Similar to above, but 216cps	£517
Star NB24-10 - 80 column 24-pin winner	£413
NEC P6 - Good Buy	£379
NEC P7 - One of the Best Sellers Ever - 24 pin	£441

DAISY WHEEL PRINTERS

Star Power Type 18cps - The Current Cheap One!	£179
Juki 6100 - 20cps - Very Popular, still no. 1	£253
Juki 6200 - 30cps - Still Popular	£393
Juki 6300 - 40cps - Very Up-Market	£639

COLOUR & INK JET PRINTERS

Okimate 20 Thermal Printer	£159
Juki 5520 - The Market Leader - Fast!	£335
Epson EX-Series Colour Option	£55
Epson SQ2500 - Ink your jet with this one!	£970
NEC P565XL - Heavy-Duty Office Favorite!	£740
Epson LQ2500 Colour Option/Makes LQ2500 Colour	£55
Seikosha MP1300 Colour Kit/Makes MP1300 Colour	£87

PLOTTERS, DIGITIZERS & LASERS

HP LaserJet II - Newer, Better, Cheaper!	£1945
Cherry A3 Digitizer Tablet	£454
Roland DXY-880A Plotter - Best Value A3 Plotter	£600
Roland DXY-990A Plotter	£922
Roland DPX-2200 A2 Flat-Bed Plotter	£2800
Epson CQ3500 - Brand new with HP Emulation!	£1222

RIBBONS

Epson FX80/85/800/LX800 (also MP165, Juki 5510)	£4.75 each
Longbow FX80/85/800/LX800 compatible ribbon	£2.80 each
Epson EX-series cartridge ribbon	£7.51 each
Longbow Oki 182/192/193 compatible ribbon	£4.61 each
Longbow NEC P3-P7 black compatible ribbon	£4.85 each
NEC P-6 black ribbon	£7.88 each
Longbow Panasonic 1080-1081 compatible ribbon	£3.18 each
Star NL10 cartridge ribbon	£4.66 each
Longbow LQ800 compatible ribbon	£2.99 each

NOTE: The minimum quantity for ribbon orders is three (3) units.

CABLES AND THINGS

IBM-Compatible Centronics Parallel Cable (Round)	£12
BBC Centronics Parallel Cable (Ribbon)	£8
Two-Way Printer T-Switch	£45
80 Col Printer Stands	£21
SpaceBase Adjustable Floor-Standing Printer Stand	£85

AMSTRAD PC

Amstrad 1512 Single Floppy/Mono Monitor	£375
Amstrad 1512 Double Floppy/Mono Monitor	£475
Amstrad 1640 Single Floppy (Colour Monitor 640k)	£587
Amstrad 1640 Double Floppy (Colour Monitor 640k)	£680
Amstrad 1640 20mb Hard Disk (Colour Monitor 640k)	£950
Amstrad 1640 Single Floppy ECD (EGA Colour 640k)	£720
Amstrad 1640 Double Floppy ECD (EGA Colour 640k)	£815
Amstrad 1640 20mb Hard Disk ECD (EGA Colour 640k)	£1075
Amstrad 1640 Single Floppy (Mono Monitor 640k)	£450
Amstrad 1640 Double Floppy (Mono Monitor 640k)	£540
Amstrad 1640 20mb Hard Disk (Mono Monitor 640k)	£810

SPECIAL OFFERS

LX-86 Auto Sheet Feed	£39
Migent Ability	£40

MACDOUGALL PC's

MacDougall 286 AT 512k 10mz/20mb HD/mono monitor	£999

EPSON PC's

Epson PC AX-20 Mark II (640k RAM, 20mb HD & EGA)	£1259
Epson PC AX-40 AT (640k RAM, 1.2mb Floppy, 40mb HD)	£1629
Epson PC AX-60 AT (640k RAM, 1.2mb Floppy, 60mb HD)	£2359
Epson PCe (20mb XT with keyboard, DOS & mono monitor)	£925

TANDON

PCA 20mb Hard Disk AT (1mb RAM Keyboard DOS Monitor)	£1299
PCA 30mb Hard Disk AT (1mb RAM Keyboard DOS Monitor)	£1499
PCA 40mb Hard Disk AT (1mb RAM Keyboard DOS Monitor)	£1699
PCA 70mb Hard Disk AT (1mb RAM Keyboard DOS Monitor)	£2099
Target 20mb Mini AT (Complete mono system)	£1499
Target 40mb Mini AT (Complete mono system)	£1699
PAC-286 (complete EGA AT with removable 32mb hard disk)	£1996

OLIVETTI PC's

Olivetti M240 Double Floppy	£759
Olivetti M240 20mb hard disk	£1092
Olivetti Mono Monitor for M240	£167
Olivetti 102-key Keyboard for M240	£120
Olivetti M380 40mb hard disk Compact System	£3307

SHARP PORTABLES

Sharp PC-7100 20mb Hard Disk Super Twist Screen	£1399
Sharp PC-7200 20mb 80286 AT (Super Twist & Super Fast!)	£2099
Sharp PC-4501 Single 3.5in Floppy, 256k, Super Twist	£699
Sharp PC-4502 Twin 3.5in Floppies, 256k, Super Twist	£875
Sharp PC-4500 Series External 5.25in Disk Drive	£250

TOSHIBA

Toshiba T5100 Laptop 40mb 80386 CGA/EGA	£3446
Toshiba T3100 20mb 80286 Portable	£2317
Toshiba T1100 Plus	£1271
Toshiba T1000	£810
Toshiba T1200	£1946

MONITORS

Eizo ER8042H 14in Ultra-High Res EGA Colour Monitor	£336
ADI 14in Mono Monitor with Tilt/Swivel Stand	£120
NEC Multi-sync EGA monitor	£459

ATARI

Atari Expandable PC Twin Drive Mono (8088/2)	£579
Atari Expandable PC 20mb Hard Disk Mono (8088/2)	£799
Atari 520STFM 512k RAM, disk drive, mouse	£250
Atari 1040STF 1mb RAM, disk drive, mouse, no monitor	£380
Atari 1040STF with Mono Monitor, 1mb RAM, disk drive	£469
Atari 1040STF with Atari SC1224 Colour Monitor	£670
Atari SH204 20mb Hard Disk Drive	£478

ATARI TOP SELLING SOFTWARE

Cyber Studio Cad 3D ver 2.0 - It's here at last!	£64
Flight Simulator II - Very Realistic Best Seller	£36
VIP Professional (Lotus Clone Gem Version)	£149
Metacomco Lattice C Compiler	£71
First Word Plus - Word Processor with Graphics	£62

CATS 'N' MICE

Mouse Systems Mouse with Pop-Up Menus & PC Paint	£140
Mouse Systems Mouse with Pop-Up Menus Only	£125
Microsoft Bus or Serial Mouse - Don't forget the cat!	£132
Logitech Logimouse C7	£77
Logitech Logimouse Plus Package	£89

DISKETTES

Computer Express 5.25in DS/DD 48tpi disks	£1.00 each
Computer Express 5.25in DS/DD 96tpi Hi-Density	£1.65 each
Computer Express Branded 3.5in DS/DD diskettes	£1.99 each
Un-branded Verbatim 3.5in SS/DD diskettes	£1.15 each

COMMUNICATIONS

Linet V21/V23 Autodial/Autoanswer	£129
Miracle WS4000 V21-V23 Modem	£129
Miracle WS3000 V22 Professional Modem	£385
Sage Chitchat Comms Pack (Modem/Software/Cable)	£181
Crosstalk Mark IV Comms Software	£93
DataSoft DataTalk Software	£89
Sage Chitchat Comms Software	£68
One-To-One Electronic Mail Subscription	£20
RS232 serial modem cable	£15

HARD DISKS

Dysan/Western Digital 20mb File Card	£279
Miniscribe 32mb Scribecard Hard Disk Card	£289
Western Digital 32mb FileCard (with X-Tree software)	£289
Seagate ST225 20mb Hard Disk w/WD controller & cables	£225
Seagate ST251 40mb Hard Disk 40ms Access (Drive Only)	£350
Plus HardCard 20mb	£525
Plus HardCard 40mb (the quality leader)	£850

TAPE BACK-UP SYSTEMS

Everex 20mb External Tape Back-up Unit	£620
Irwin 20mb Internal Tape Back-up Unit	£360

ADD-ON BOARDS

AST SixPack Plus 64k memory Multifunction Card	£165
Qubie SixShooter Multifunction Card 64k memory	£125
Intel AboveBoard with 0k installed	£199
Everex Mini Magic Ram Expansion Card (384K)	£117
Hercules Graphics/Graphics Plus Card	£179
Everex EverGraphics Plus (Clone Hercules Card)	£95
Eizo Auto-Switch EGA Card	£199
Paradise Auto-Switch EGA Card	£219
AST Rampage	£200
AST 3720 Terminal Emulation Card	£649
AST 5251 Model 12 Remote Emulation Card	£525
AST SixPack Premium 256k Clock Parallel & Serial	£330
AST SixPack Premium 1mb EMS daughter board	£150
SageNet 2-User System	£275

CHIPS, CO-PROCESSOR AND DRAM

64k dRAM chips (nine to make 64k)	£1.15 each
256k dRAM chips (nine to make 256k) 150 N.S.	£3.00 each
Intel 8087 5mz Maths Co-Processor	£95
Intel 8087-2 8mz Maths Co-Processor	£135
Intel 80287-8 Maths Co-Processor	£185

IBM-COMPATIBLE SOFTWARE

PC-MOS by Software Link - The MS-DOS Challenge!	£175
WordStar 2000 Plus release 2	£228
WordStar 3.4	£143
WordStar Professional Version 4	£192
Word Perfect ver 4.2 - The Number 1 WP Package	£219
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Quaid Software Copywrite (Back up Protected Software)	£40
Microsoft Flight Simulator - Gives You a Lift!	£39
Microsoft Quick Basic version 3 - The Ultimate Basic	£53
Funk Software Sideways	£40
Borland Turbo Lightening	£47
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Norton Utilities 4 - Every user need this one!	£51
Norton Commander - Control program for power users!	£35
Ventura Desk Top Publisher	£465
Freelance Plus	£266
Delta Professional	£319
Ansa Paradox II - Multi-User Database!	£289
Cardbox Plus	£225
Ashton-Tate Rapid File	£199
dBase III Plus - Best Selling Professional Database	£385
FoxBase Plus	£269

LOW-COST SOFTWARE

VP Planner by Paperback Software - Best Seller!	£61
VP Info (dBASE II Clone)	£62
VP Expert	£75
VP Graphics	£64
Borland Sidekick - The Original Co-Resident Process!	£43
Borland Turbo C - C How You Like This!	£55
Borland Turbo Pascal - The Classic Borland Product	£47
Borland Turbo Basic	£47
Sage Bookeeper	£71
Sage Retrieve Database	£71
Sage PC Planner Spreadsheet (Lotus Clone)	£71
Sage Desk-Set	£49
Sage PC-Write Word Processor	£71
Sage Accountant - For the Small Business	£110
Sage Accountant Plus - Top Selling Cheap Accounts	£143
Sage Payroll - A Fun Event	£71
Sage Financial Controller - The Sage Top of the Range!	£216
Personal Word Perfect	£139
Word Perfect Junior	£75
Microsoft Word Junior	£59
WordStar 1512	£60
Amstrad Multiplan Junior	£59
Amstrad Supercalc 3	£60
Amstrad Amstrad Reflex	£60
Migent Ability - Top Integrated Package	£40
Migent Ability Plus - Spend a Little More, Mate!	£103
Words & Figures - Lotus 123 v1 Clone with WP	£80

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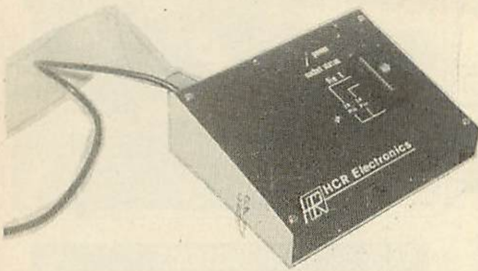
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128K EPROM PROGRAMMER

Again a quality-built product, cased in steel two tone case and comes complete with software in ROM, ZIF socket and all cables. This is the follower of the well proven 64K Micron Plus EPROM Programmer.

THE SPECIFICATION

★ Programme 2716, 2732, 2764, 27128, 27256, 2532, 2564, 27512, 27513, 2516, 27011, 2732A, 2764 etc.
★ Programs all EPROMS up to 27512 (64K) in a single pass (master only).
★ Programs all EPROMS up to 32K in a single pass (BBC B).
★ Fully buffered
★ Software selectable programming voltage 12.5/21/25 volt
★ Normal or high speed algorithmic method of programming (software selectable).
★ Continuous display of option selected.
★ ZIF socket powered down when not in operation.
★ Mains derived self contained power supply.
★ VCC is raised to 6V during programming in line with manufacturers' recommendations.

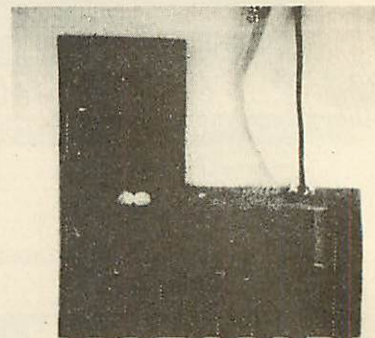
SOFTWARE ON ROM INCLUDES

★ Fully menu driven
★ Automatic verification on completion of programming and fault listing.
★ Built in full screen memory editor (buffer is 32K long).
★ Software allows blank check or EPROM and automatically lists faults.
★ Will copy EPROMS to buffer or file.
★ Will generate checksum.
★ BBC format ROM images may be created using a number of images of basic or machine code programs.
★ More than one image can be stored on one ROM.

This programmer has been designed and manufactured by H.C.R. Electronics to industry standard. Our engineers are on hand for queries relating to this product.

Price only £68.00 + £10.20 VAT + £3.00 P&P.

16 SOCKET ROM/RAM EXTENSION BOARD
+ 32K PLUG IN RAM CARD



Fully buffered the board offers the following features:

All 16 sockets may contain 8K or 16K roms.

Up to two pairs of sockets may be configured to accept 8K eproms to simulate a 16K eprom without the expense of a 27128.

Up to 16K of CMOS RAM type 6116LP (made up of 8 2K ram chips) may be fitted to 8 of the available sockets leaving 8 free for roms.

or 2 8K Ram chips (6264) leaving 14 available sockets.

The advantage of sideways ram is twofold:

1. Programs can be assembled directly to hex 8000 and debugged before being committed to eprom.
2. Programs intended for sideways roms may be stored on disc and downloaded into ram. Many more programs may be kept on disc allowing the extension board to be fitted only with roms that need to be resident.

This is a high quality PTH board and plugs into the extreme right hand rom socket.

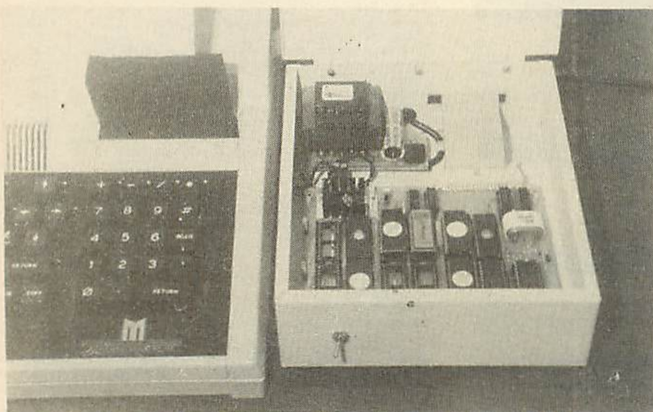
4 wires to the paging register and one lead to the R/W line have to be connected.

BATTERY BACK-UP FACILITY
Separate power leads for the board

are used to eliminate possible crashes that may occur due to trying to draw up to 650mA from a sideways rom socket.

Board fully assembled and tested complete with full installation and operating instructions.

Cost £32.00 + VAT, £1.00 P&P
Also available: 32K plug in RAM card. Will fit directly into ROM socket on above board.



EXTERNAL EPROM EXPANSION FOR BBC MODEL B + MASTER

'Master' EPROM Expansion

The expansion unit will hold up to 12 ROM's. The ROM's may be 8K, 16K or 64K. The unit is plugged into the 'Master' cartridge socket via a cable and adaptor. The ROM's are selected as 3 banks of 4 ROM's. Each bank can contain up to 16, 16K ROM images, if 27512 EPROM's are used. In addition, 16K bytes of battery backed up RAM can be fitted, this RAM can be read and write protected.

1 CARD SYSTEM £68 + £3 p&p + VAT
ADDITIONAL CARD SYSTEM £20 + £1 p&p + VAT

BBC Model 'B' EPROM Expansion

The expansion box will hold 12 ROM's as standard and 24 in total with the addition of the second board. The ROM's may be 8K or 16K. The unit is connected via one of the internal ROM sockets and a buffer board, no soldering is required to fit the unit. When a box with expansion board is fitted each card of 12 ROM's exist in the sideways ROM area, and are addressable at any time. Switching between the cards is software controlled. Up to 64K of battery backed RAM (32K per card) can be fitted. This memory can be read and write protected. Both units are mains powered.

1 CARD SYSTEM £75 + £3 p&p + VAT
ADDITIONAL CARD SYSTEM £29 + £1 p&p + VAT

ORDERS TO:
H.C.R. ELECTRONICS,
H.C.R. HOUSE, BAKERS LANE, INGATESTONE
ESSEX CM4 0BZ. Tel (0277) 355407/8



ALSO AVAILABLE

Ram Card (Sideways)
32k, easy to fit, write protect switch, can be addressed direct, software available.

£30.00 + VAT (£4.50) + £1 p+p

27C 128 Eproms 10 off

£2.50 each + VAT + 50p p+p

Computers by Post

LOWEST U.K. PRICES GUARANTEED



PRINTER RIBBONS

		2+	5+	12+
ACORN	AP80	£2.70	£2.20	£2.00
	AP100	£2.70	£2.20	£2.00
AMSTRAD	DMP1	£3.90	£3.30	£3.10
	DMP2000/3000	£4.40	£4.10	£4.00
	PCW8256/8512			
	Red or Blue	£5.50	£5.20	£5.00
BROTHER	HR5	£3.00	£2.80	£2.60
	HR15 Corr	£2.90	£2.50	£2.30
	HR15 FAB	£3.30	£2.90	£2.60
	HR15 MS	£3.20	£2.80	£2.50
	HR15 also for HR25/HR35			
	EP44	£2.90	£2.50	£2.30
	M1009	£3.40	£2.90	£2.70
CANON	PW1080A Black	£3.10	£2.60	£2.40
	PW1080A Red or Blue	£4.50	£4.10	£3.80
	PJ1080 Ink Jet Colour. One Off			£10.90
	PJ1080 Ink Jet Black. One Off			£8.90
CBM	1515	£2.70	£2.20	£2.00
	1525	£2.70	£2.20	£2.00
	MPS801	£3.60	£3.00	£2.80
	802/1526	£3.70	£2.90	£2.70
	803	£3.40	£2.90	£2.70
	MPS1000	£2.70	£2.30	£2.10
	4022	£2.70	£2.30	£2.10
	MSC801 Colour. One Off			£18.50
	DPS1101 SS	£2.40	£1.90	£1.75
	DPS1101 MS	£2.90	£2.50	£2.30
	DPS1101 Corr	£1.80	£1.50	£1.40
CENTRONICS	GLP 1/2	£3.40	£2.90	£2.70
CITIZEN	120D	£5.00	£4.60	£4.30
DAISYSTEP	2000 MS	£3.10	£2.60	£2.40
	2000 FAB	£4.90	£4.20	£4.00
EPSON	MX/FX/RX80 Black	£2.70	£2.30	£2.10
	MX/FX/RX80 Red or Blue	£3.90	£3.20	£3.00
	100 Series	£3.70	£3.30	£3.00
	LX80/LX86	£2.70	£2.30	£2.10
	JX80 Colour. One Off			£18.50
	LQ800	£3.70	£3.30	£3.10
	LQ1000	£4.50	£3.90	£3.60
JUKI	6000/2200 Corr	£3.10	£2.70	£2.50
	6100 MS	£2.90	£2.50	£2.30
	6100 SS	£2.40	£1.90	£1.75
	6100 Corr	£1.80	£1.50	£1.40
KAGA	KP810 Black	£3.10	£2.60	£2.40
	KP810 Red or Blue	£4.50	£4.10	£3.80
M/TALLY	MT80	£3.70	£2.90	£2.70
OKI	80/82	£1.40	£1.10	£1.00
	84	£3.90	£3.40	£3.20
	Mate 20 Colour	£7.00	£6.50	£6.20
	Mate 20 Black	£6.60	£6.20	£6.00
PANASONIC	Dot Matrix	£5.00	£4.60	£4.30
QUENDATA	DWP1120 MS	£3.10	£2.60	£2.40
	DWP1120 FAB	£4.90	£4.20	£4.00
QUME	Sprint 7/9 MS	£2.80	£2.30	£2.10
	Sprint 7/9 FAB	£4.00	£3.70	£3.40
SEIKOSHA	GP50	£6.00	£5.50	£5.20
	GP80	£2.70	£2.20	£2.00
	GP100/250	£2.60	£2.20	£2.00
	GP500/550	£3.90	£3.30	£3.10
	GP700 Colour. One Off			£18.50
	SP1000	£6.00	£5.50	£5.20
SHINWA	CP80	£3.70	£2.90	£2.70
SMITH CORONA	Fastext 80 (Twinpack)	£11.70	£11.20	£10.90
	TPI M/S	£12.50	£10.70	£9.95
	TPI Fabric	£5.70	£5.25	£4.95
	TPI Corr	£5.00	£4.70	£4.50
	D100/200	£4.80	£4.40	£3.90
	D300	£6.00	£5.50	£5.30
STAR	DP/GEMINI/SG	£1.40	£1.10	£1.00
	SR15	£4.90	£4.50	£4.30
	NL10	£5.00	£4.40	£3.70

DISK STORAGE

LOCKABLE DISK BOXES

MODEL	SIZE	CAPACITY	PRICE
DD40L	3"/3.5"	40	£8.50
GS100	3.5"	100	£13.90
DD50	5¼"	50	£8.90
DD100	5¼"	100	£11.70
LIBRARY CASE	5¼"	10	£1.50
NON-LOCKABLE DISK BOXES			
MD12/30	3"/3.5"	24	£7.20
MF50	5¼"	50	£8.00

COMPUTER STATIONERY

PLAIN WHITE WITH MICRO-PERF EDGES PRICE

SIZE	GSM	QUANTITY	1 BOX	2 BOXES
11 x 9½	60	2000	£13.50	£13.00
11 x 9½	70	2000	£16.50	£15.50
EXACT A4	70	2000	£21.90	£19.75
11⅔ x 9½	90	1000	£14.20	£12.25

LASER PRINTER CONSUMABLES

TONER CARTRIDGES

Epson GQ3500	£18.50	Canon A1/A2	£74.95
Oki Laserline 6	£18.50	Canon A8 Mk II	£84.95
HP Laserjets	£74.95	QMS K8	£74.95
HP Laserjet Mk II	£84.95	Citizen Overture	£22.95

FLOPPY DISKS

5¼" — BOXES OF 10 DISKS

JVC inc Plastic Case		1-2	3-9	10+
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North London. BBC Micro Users Group: Mr Ric Keyworth, 'The Penthouse', 4b Kilburn High Road, London NW6 5UL Tel: 01-734 9235
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Wandsworth. Wandsworth Computer Club: C Kendrick, Earlsfield Library, Magdalen Road, London SW16
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Brighton. Brighton Area Micro Enthusiasts: c/o 41 Westdene Drive, Brighton. Prestel mailbox 919995582. Contact Mr Edwards
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Cambridge. Bottisham Acorn User Group: Peter Rank, Tel: Cambridge 812080, or Gerald Wilcockson, 19 Gallows Hill, Saffron Walden, Essex CB11 4DA Tel: Saffron Walden 23793
Derby. The Derby Microcomputer Society: F Taylor, Secretary, c/o 5 Park View Close, Allestree, Derby DE3 2GH Tel: Derby 559334
Derby. Mrs B Bowman, 6 Shady Grove, Hilton, Derbyshire DE6 5PX. Tel: (028373) 2529
Dudley. Kingswinford BBC Micro Club: Kingswinford Community Centre, High Street, Kingswinford, Dudley, West Midlands Tel: Dudley 212538
Glossop. Glossop Computer Club (Derbyshire): T S Fox, 4 Park Lane, Little Hayfield, Stockport, Cheshire SK12 5NW Tel: (0663) 44260
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Liverpool. Mersey BBC User Group: Nik Kelly, 56 Queen's Drive, Liverpool L4 6SH
Rochdale. Beeb owners group, 81 Mornington Road, Kirkholt, Rochdale. Lancs. OL11 2OJ
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Australia. Dapto BBC User Group: PO Box 447, Dapto, NSW 2530
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Master 128, co-processor 512, switchable twin disc drives, plinth, books, software. Offers welcome. Tel: 01-482 1635. After 7pm please.

Master 128k 3.5 and 5.25-inch 640k drives colour TV/monitor, plinths, discs, reference manuals etc. Everything boxed £700 ono. Tel: Southport (0704) 43222.

Torch Z80 second processor. Dual 80-track drives. Perfect software £300. Propascal £100. AMX Mouse & *Pagemaker* £30. BBC B DFS 0.90 monitor lots of ROMs £200. Tel: 01-440 4545.

Penpal wanted for BBC B addict with disc drive. Serious and fun applications. Ken Parker, 20 Jermyn Drive, Arnold, Nottingham NG5 9PN.

BBC B, DFS, 40/80 double sided drive, manuals, *AMX Super Art* ROM, *Repton 2* and *3 Thrust*, *Elite*, + more. £250. Tel: (0273) 415853 Evenings.

BBC B Watfords DFS, shadow Ramcard, 32k sideways ROM/RAM board, 1 x DS + 1 x SS 40-track disc drives, software, books £330. Tel: 01-953 6311.

BBC B Acorn DFS, 400k D/S drive, Acorn tape recorder, speech chips, replay, joystick and interface, software, books, magazines. £380. Tel: 021-477 3776.

Watford 32k shadow RAM board £40, Watford solderless ROM board + 16k sideways RAM £25, original packaging and documentation. Tel: 01-380 9319 (Days).

Wanted twin 40/80 switchable disc drives with PSU. Tel: Mike (0942) 426784 evenings.

ADE+ macro assembler two 16k chips + disc + manuals £25. ISO-Pascal chips and manuals £20. Tel: John 091-285 3231 (Evenings).

Watford Le Modem £70. Acornsoft Pascal sag and boons £80. BCPL ROM £35. EMR MIDI pack £90. Tel: Adam (04484) 3225.

BBC B issue 7 Acorn DFS, ADFS. Speech synthesiser cartridge socket. Light pen. Olivetti drive, much software. £350. Tel: (0226) 203221.

BBC B + 128 1770 DFS + manuals £320. 40/80-track D/S drive + PSU £70. Microvitec colour monitor £60. Tel: 091-285 3231 and ask for John (Evenings).

Acorn Prestel Adapter £50, Max ROM (BBC B) £10 *Opus* DDOS £25. Tel: (0455) 212283.

Penpals wanted BBC B with SWR 32k, disc drive. Swap tips etc, Ian Williams Room B13, Alexandra House, 59 Imperial Road, Exmouth, Devon EX8 1AU.

Watford DFS and manual full fitting instructions. Canon 40-track D/S drive with utility disc. Offers? Tel: Bude (0288) 3100.

Viglen console suitable for BBC B. Unwanted present. £25 ono. Hickson, Tel: (0606) 75031 Northwich Cheshire.

Wanted teletext adapter for BBC B preferably Morley. Tel: Pete, 021-705 6657 after 5.30pm.

Surplus following upgrade – two Cumana CS100 drives, £50 each, £90 the pair. Can be seen running. Tel: (037 882) 2622 Evenings.

BBC B 1.2OS, Opus DDOS, 6502 processor, two drives, PSU, ATPL Board, *View*. Replay, green monitor, etc. £550 ono. Tel: Plymouth 666760.

Watford video digitiser £85. AMX Mouse £30. SPY 2 and *Disc Doctor* £8 each. Electron £30. Various BBC books. Tel: 041-427 4114.

BBC B in good condition with three joysticks and software. £200. Tel: 021-353 9060 after 5pm.

Dinosaur disc drive (100k) £34, modern disc drive (400k) £88. Both 5.25-inch, unused. *InterWord* £25. Games collection £22. Seth 01-743 5294.

Acorn 6502 second processor, DNFS, Hi-Basic as new £100. Tel: (0525) 370686.

20Mb hard disc with controller, PSU, metal case, complete requires ADFS. Nearly new. £350 ono. Tel: Chris (0276) 65675 Evenings.

Wanted, *Acorn User* No.9 (Apr.83) and No.17 (Dec.83) in excellent condition. Stuart Moorse, Tel: Cambridge (0223) 834185, after 6pm.

Wanted BBC B, Hi-Res green monitor, DS-DD 40/80 dual, Canon printer PW1080A. CASH waiting. Tel: 01-693 5849.

80186 and Z80 second processors for sale. All original software included. Offers to Philip Langsdale. Tel: 01-226 0976 After 8pm.

Acorn Z80 second processor with original software and manuals £175. Tel: (0252) 546029 (Evenings) or (0483) 509210 (Day)

Desk with drawers suitable for computer £25. Also *Advanced Disc Investigator* original package £12. Tel: (0342) 713529.

Acorn User magazines. Complete set of 1986 issues £5. Tel: (0246) 415099.

Electron, Plus-1, *View*, *Viewsheet*, Lisp, Pascal, CC *Graphics* ROM, Adv User guide, E2P PCB with OS and instructions. £130 ono. Tel: 051-546 1543.

Disc drives. Watford dual 5.25-inch 800k drives 40/80-track switch £120 ono or exchange for Morley Teletext. Tel: Dave 061-430 2060.

BBC Master 128k, new, will sell for £385. Tel: 01-882 3248, ask for Roopesh OR Rasik.

Watford ROM/RAM board 112k SWRAM, battery, disc, manual, £40. *NLQ*, *Sleuth* ROMs £12 each. Tel: 091-267 7302 evenings.

Grundig Satellite 600 prof. programmable short-wave receiver suitable for Weather Fax £250. Tel: (0705) 594438.

BBC QES 2.00 disc drive 40/80 switchable, mono monitor, tape recorder, joystick original games. Issue 7. Le Modem £400 ono. Tel: Guildford 572018.

Swap original AMX Mouse *Super Art* ROM, manual, discs including *Desk*, *3-D Zicon*, etc. for teletext adapter or sell. Tel: Nottingham (0602) 723914.

BBC B, DNFS, 64k SWR, 32k shadow, mouse, Microvitec monitor, 400k disc drive, joysticks etc. £500 ono. Tel: 01-874 8548.

Plotter, Linear Graphics A4 plus Linscan, both as new. Best offer secures. Tel: (0662) 3597) After 6pm.

FREE PERSONAL AD SERVICE

Fill in the form below to a maximum of 20 words (one in each box) and send it to *Acorn User* Free Ads, 20-26 Brunswick Place, London N1 6DJ. Please use capital letters, write clearly, and remember your name, address and telephone number. Without this full information, supplied on a separate sheet of paper, we regret we cannot carry your Free Ad. We cannot accept entries selling or swapping software. This is a service to readers – no companies please. One entry per form only. Free Ads are carried in the magazine as space permits, and any Free Ads not used within a month of receipt will be disposed of.

ACORN USER'S

DIARY

Arthur needs a minder

Some Archimedes 440s have been seen running Arthur 1.1 and carrying a prominent sticker with a warning message to the effect that it could destroy files by accident all on its own! However, the earlier Arthur 0.3 had no such warning. Is the Archimedes ADFS afflicted with the 'Master 128 DFS syndrome', where each successive new version carries more bugs than the last?

What a card

Minerva's add-on card index application for *InterBase* users has put the cat among the pigeons. Computer Concepts *will* be selling rival Minerva's software – but they won't be advertising the fact, says CC's Rob Pickering. Seemingly, it's too close to an admission that the card index supplied with *InterBase* is useless.

But wait! Computer Concepts are reportedly reacting to harsh criticism, and hurrying to rewrite both the manual and their own card index.

Bogs betwixt Bell and Ben

Big Ed Quinn and tech man Bell set out bright and early for this year's annual Big Ben Show in Holland, land of windmills and telefoons. But despite allowing two whole days to get there, chauffeur Quinn had problems – Bell kept navigating the Reliant Robin towards Utrecht.

After being beaten into submission with a bunch of tulips, Bell revealed that he really wanted to go to an international bog conference being held that very weekend. Yes, Mr Bell is really into those wet sludgy places, having been an ecologist before being reincarnated as a wirehead!

Turnout for the show was good. Acorn's brand new Dutch distributor was there with almost six Archimedes. This included almost three A440s – we didn't think Acorn had that many.

The Dutch are hoping for big things in the university sector, with Delft producing the teletext package *Acorn* (née *Poseidon*). There were even rumours of a public domain Unix system.

The main event of the show was rival magazine *A&B Computing*. The discerning Dutch weren't very impressed. At a loss for something to do, *A&B* eventually left their hotel early and slunk back to England in their 2CV. As Ed Mark Webb explained: 'We couldn't sell a single copy.' Not surprising given the up-to-the-minute news in their November issue.

> LATEST NEWS
>
> **Show dates**
>
> Acorn User Show
> 23rd to 27th July
> Barbican
>
> MUSE summer conference
> 27th to 29th
> Nottingham University
>
> Econet '87
> September 30th to October 1st
> Leicester University

Up-to-the-minute news from *A&B*, published October 2

1 Across. Attitude of Acorn Computers (anag)

Acorn has at last announced their 'recommended retail prices' for the Arc, explained a company spokesperson. They are some £100 lower than the previous 'indicator' prices, he stressed. Here is the old 'indicator price list' distributed by Acorn at the recent *PCW* show. A 305 is now £699 plus VAT, very reasonable for the machine voted 'Home and small business micro of the year' in the British Micro Awards ceremony at the show. It would have been simpler to have announced a price drop.

Code	Description	RRP Including VAT	RRP Excluding VAT
	ARCHIMEDES COMPUTER SYSTEMS		
AKB10	Archimedes 305	916.60	799.00
AKB10/ AKF01	Archimedes 305 Mono System	974.10	849.00

Acorn's carefully labelled 'indicator' prices

A new Macintosh program to work out anagrams has come up with some revealing phrases, writes an anonymous correspondent, 'Tefal'. Have you realised that 'Acorn Computers' is an anagram of the phrase 'ARM concept sour'? And what about 'Same corrupt con'? (And there's worse if you try hard enough – as a family magazine we can't print what they do 'on customers'!) Coincidence? We think the public should be told.

Spellbinder

SEARCHING A ROOM

A DEATHMONK APPROACHES

ANOTHER NASTY CONFRONTATION

WANDERING THROUGH WOODLAND

Leg of Toad, and Golden Fruit,
Mix with Ashes and Nightshade Root.

At the end of the thirteenth century, there lived in the land of Lorraine ten wise and powerful Magelords. Each of them had studied sorcery and enchantment from childhood days, and each knew how to evoke potent spells capable of causing metamorphosis and devastation.

You play the role of one such Magelord named Eldon The Spellbinder. Your task is to find the evil Zorn, who has deserted the Magelord brotherhood and fled to the Castle of Lorraine.

Then, by collecting the correct ingredients, you must mix the Ultimate Spell, cast it at Zorn and banish him for good.

A captivating 3D arcade-adventure full of problems to be solved by magical means. Only the appropriate ingredients mixed in the correct order will produce all the powerful spells which you need to complete your mission of destiny.

BBC Micro Cassette	£9.95	Acorn Electron Cassette	£9.95
BBC Micro 5¼" Disc	£11.95	Acorn Electron 5¼" Disc	£11.95
BBC Master Compact 3½" Disc	£14.95	Acorn Electron 3½" Disc	£14.95

(Compatible with the BBC B, B+ and Master Series computers).

The screen pictures show the BBC Micro version of the game.
The graphics of other versions may vary.

PRIZE COMPETITION

If you complete the Spellbinder mission (by killing the evil Zorn), you can enter our competition. Prizes include a superb engraved trophy, with Spellbinder T-shirts and signed certificates for runners-up.

Closing Date: 30th June, 1988.

SUPERIOR SOFTWARE Limited

ACORNSOFT

Dept. SPR2, Regent House, Skinner Lane, Leeds LS7 1AX. Telephone: 0532 459453

Please make all cheques payable to "Superior Software Ltd".





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- All mail orders are despatched within 24 hours by first-class post.
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- Faulty cassettes and discs will be replaced immediately.

(This does not affect your statutory rights)

ZARCH

PRIZE COMPETITION

Can you become the Zarch world Champion?

The player who achieves the highest game score will be awarded an impressive trophy and the original artwork for Zarch, framed and autographed.
There are also 50 Zarch T-shirts for runners-up.
Closing Date: 31st July, 1988.


Leaving the Home Base — the Mission commences


A landed Seeder spreads the debilitating red virus


A raging battle against several alien spaceships


Flying fast and low over a hilly coastline

Zarch — a revolution in software

David Braben is the co-author of the unanimously acclaimed game, Elite — probably the world's highest-selling computer game.
After months of program development work, David has now harnessed the speed and performance of the Archimedes computer to create another programming masterpiece... Zarch.

Zarch is unlike any game you have ever seen before. Even the demonstration program, Lander, supplied on the Archimedes Welcome disc, can only give the most basic idea of the features and fascination that Zarch has in store.

For the Archimedes computer: £19.95 (on 3½" disc)

SUPERIOR SOFTWARE Limited

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Dept. ZR3, Regent House, Skinner Lane, Leeds LS7 1AX. Telephone: 0532 459453

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